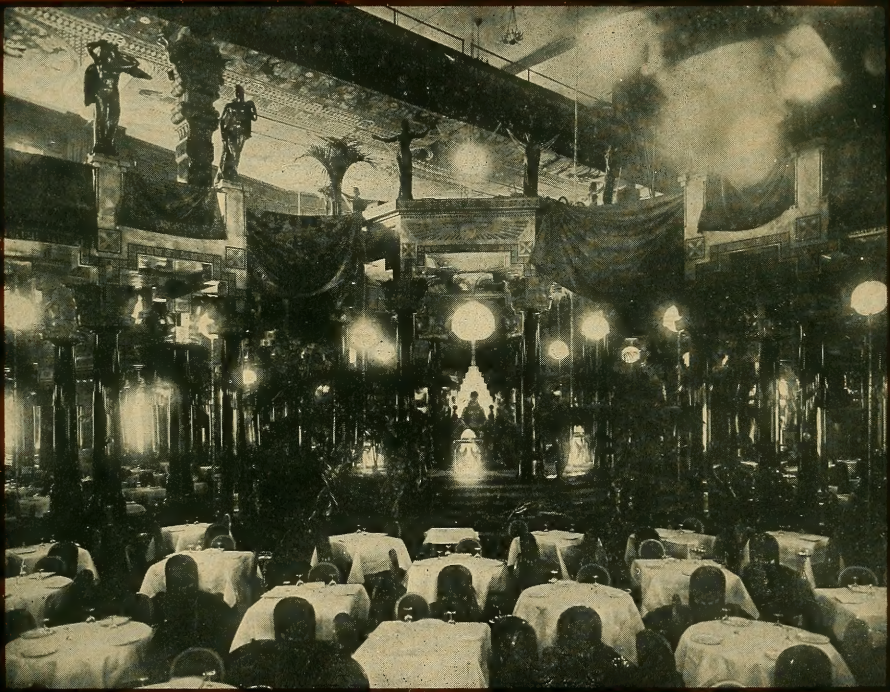
MARCH, 1910

THE ILLVMINATING ENGINEER

EDITED BY E. LEAVENWORTH ELLIOTT.

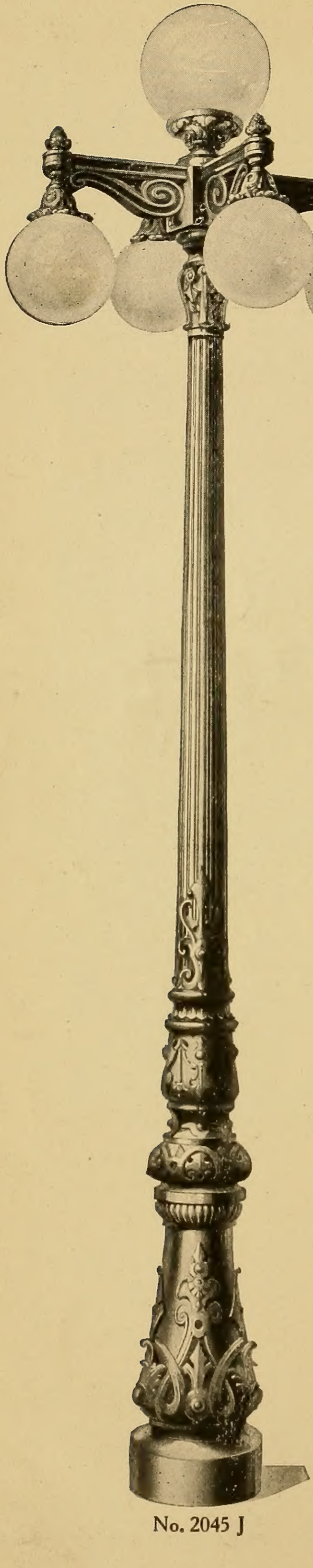


CAFE de L'OPERA, NEW YORK

ILLVMINATING ENGINEERING
PVBLISHING COMPANY.
NEW YORK.

20 CENTS A COPY

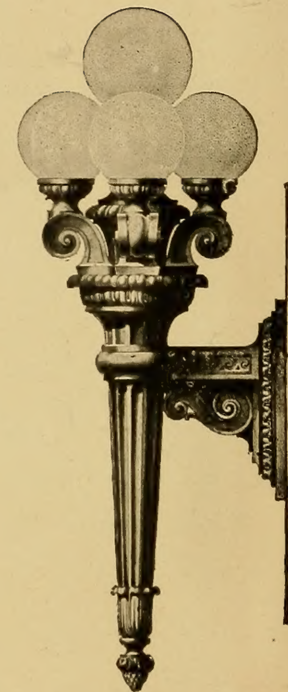
Mott Lamp Posts



No. 2045 J

are invariably selected where quality as well as price is considered in the competition. A reputation of over three-quarters of a century standing is too valuable an asset to take any chances with; Mott goods **must** be kept up to the Mott standard **in every particular.**

Reputation means quality and fair dealings **always.**



No. 2056 J

ESTABLISHED 1828

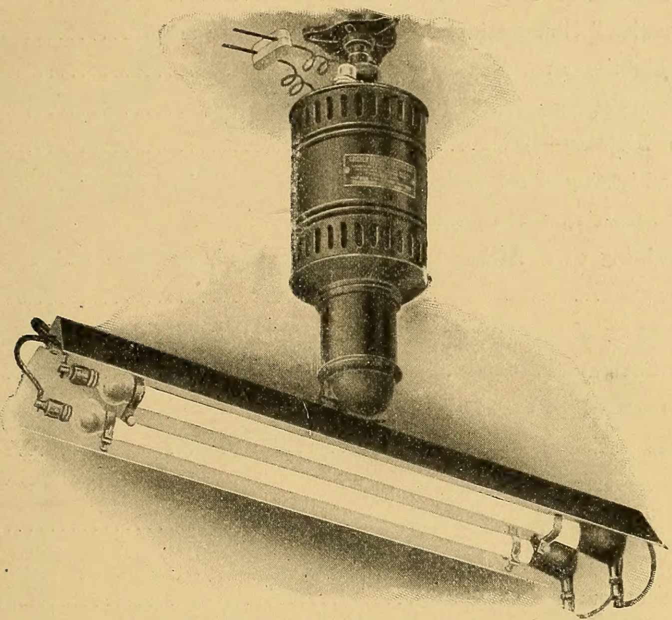
The J. L. MOTT IRON WORKS

Fifth Avenue and Seventeenth Street

NEW YORK

THE COOPER HEWITT LAMP

"Better than daylight"



TYPE H H LAMP—AUTOMATIC LIGHTING

INSPECTION

The inspector is the guardian of the manufacturer's reputation. Mistakes will happen in the best regulated factories and imperfections in the product will appear so long as human nature itself is imperfect. Eternal vigilance is the price of quality.

The inspector's ability to detect imperfections depends mostly upon his acuteness of vision. Both the thoroughness and rapidity with which he can perform his work depend largely upon the quality of illumination used. The Cooper Hewitt Lamp is simply incomparable with any other light source for this important work, **not excepting daylight**. Textile mills have found by actual experience that goods can be inspected more thoroughly and **four times as rapidly** under Cooper Hewitt light than by daylight; and other artificial lights are hardly worth comparing.

In foundries it has been proven that imperfections otherwise imperceptible to the eye in ordinary daylight were plainly visible by Cooper Hewitt light.

Cooper Hewitt light is really better than daylight.

Until you have *fully* investigated the Cooper Hewitt Lamp you are in no position to decide on the best form of illumination for your use.

Remember—

LIGHT IS CHEAPER THAN LABOR

COOPER HEWITT ELECTRIC CO.

222 West 29th Street 15459 NEW YORK

Contents of This Issue:

Published on the first of each month by

ILLUMINATING ENGINEERING PUBLISHING COMPANY

E. L. ELLIOTT, Pres. H. RIDDELL, Vice-Pres. E. S. STRUNK, Secy-Treas.

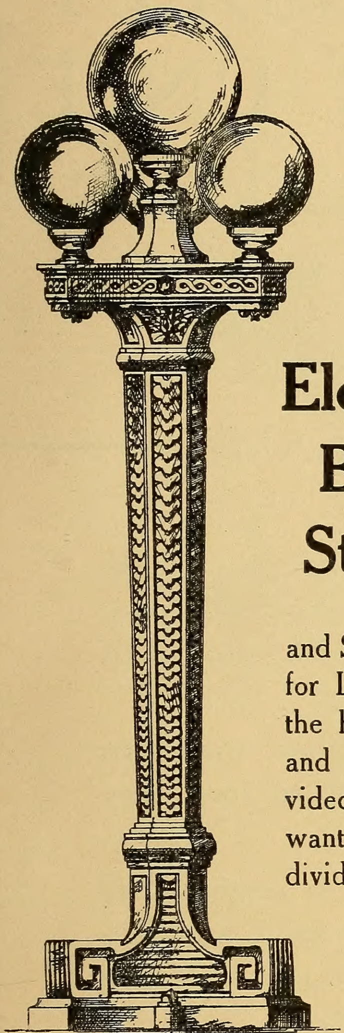
36 WEST THIRTY-NINTH STREET

CABLE ADDRESS ILLUMINEER — NEW YORK — LIEBER'S CODE USED

WESTERN REPRESENTATIVE: G. G. PLACE, 1321 West Adams Street, Chicago, Ill.

SUBSCRIPTION RATES: In the United States, Canada, Mexico, Cuba, and Shanghai, $2.00 a year. Elsewhere in the Postal Union, $2.50 a year

Entered as Second Class Matter January 13, 1907, at the Post Office at New York, N. Y.



No. 51

Lamp Posts

to meet the requirements of the new street lighting for both arc and tungsten lamps.

Electroliers
Brackets
Standards

and Special Art Designs for Lighting Pieces of the highest conception and workmanship, provided for those who want Character and Individuality. :: :: ::

Write for any information you may desire—prices, etc.; for while our work is good, the cost is not excessive. . . . . .

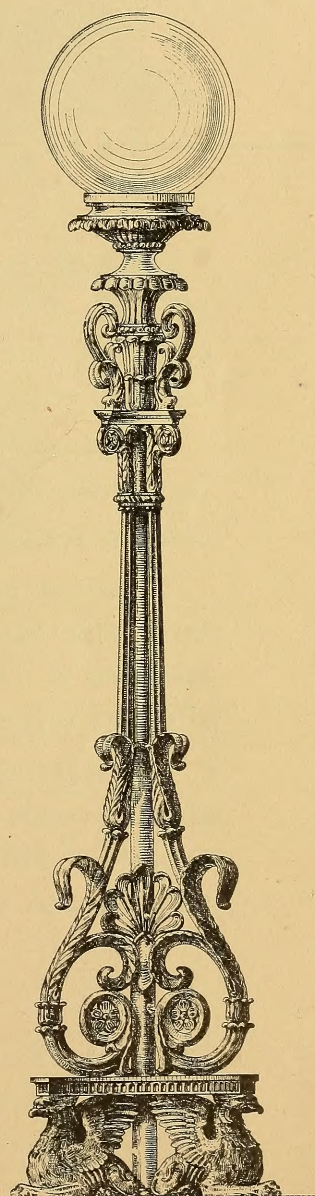
The

Smyser-Royer Company

Office and Studio

1506 Sansom Street, Philadelphia, Pa.

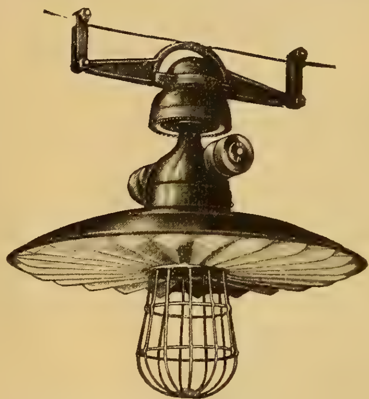
Factory at York, Pa.



No. 133

Westinghouse

Series Tungsten Street Lighting



Westinghouse Street Hood with Radial Reflector Complete for Center Span or Cable Suspension

Two Systems

The Adjuster-Socket System

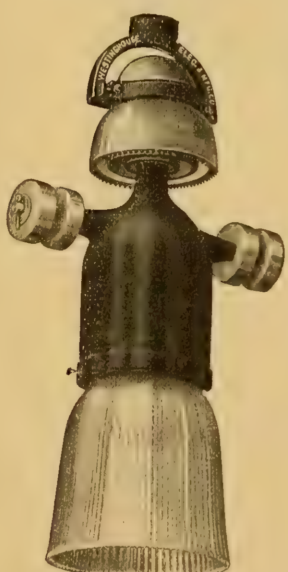
consists of a simple series of lamps connected across the high-tension alternating current mains, with an impedance coil connected in shunt to each lamp. This coil takes a very small current when the lamp is burning, but when the circuit through the lamp is broken the whole current passes through the coil, which has a resulting impedance practically equivalent to that of the lamp, so that the voltage on the remaining lamps in the circuit is maintained at normal value.

The Regulator System

employs regulating transformers to furnish a current of constant value to the circuit of series lamps, each of which is bridged by a film-gap, through which the continuity of the circuit is maintained, should the lamp burn out or become broken.

We carry a complete line of this apparatus in stock.

Ask nearest office for Catalogue Section No. 286.



Westinghouse Series Tungsten Street Hood with Holophane Reflector Complete for Bracket Suspension

Westinghouse Electric & Manufacturing Co.

Atlanta	Buffalo	Cleveland	Los Angeles	Philadelphia	Salt Lake City
Baltimore	Chicago	Denver	New Orleans	Pittsburgh	San Francisco
Boston	Cincinnati	Detroit	New York	St. Louis	Seattle

Westinghouse Electric & Mfg. Co. of Texas, Dallas, Texas.
Canada: Canadian Westinghouse Co., Ltd., Hamilton, Ont.
Mexico: G. & O. Braniff & Co., City of Mexico.

Don't Kick—Read!

Some poet has said that " Man was made to mourn." He might have added with equal truth that " Man is made to kick." In fact, he generally " mourns " when " kicking " proves ineffectual. Undoubtedly we all have many just causes for kicking. Our food is often badly cooked and served; the trusts have put up the cost of living; the government is debased by grafting; our salaries and profits are too small; the street cars are crowded, and our lighting bills are altogether too high, especially in view of the measly, dim light that we get.

" It is hard to kick against the pricks," says the Scripture, and we may not be able to make much headway against the wicked trusts, the bad politics of the other party, and the stupidity of the world in not taking us at our own valuation. But where a little thought and attention will mend matters, is there anything more stupid than to let them go, and keep on kicking? This happens fortunately to be the case in the matter of light. If you do not have a light by which to read your evening paper, or do your office work, or run your factory that is so nearly equal to good daylight as to make it doubtful which is which, you have only yourself to " kick "; for one-quarter of the time that you spend in ineffectual railing at public abuses applied to studying the subject of illumination as set forth from month to month in THE ILLUMINATING ENGINEER would relieve your eye-strain, and put your nerves in such condition that you would see life through very different-colored glasses.

You should begin this very minute by reading " The Year's Progress in Illuminating Engineering," which will give you, as it were, the synopsis of the part of the story that you have missed. And then read the opinions of the leading commercial interests in the lighting field, as set forth in special letters to THE ILLUMINATING ENGINEER.

Then read about what the people in Newark, Ohio, and Wichita, Kans., and Chicago have done to brighten up their cities with new electric lamps, and see that your own town gets a start in the same direction; you will think less about the incompetence of your city government if you take a hand in it yourself.

Ever heard of " Alternating Illumination "? Mr. A. J. Marshall sets forth a very original idea as to the proper exercise of the eyes. It is really " worth considering."

Does your pastor preach dull sermons, which give you a headache before he gets through? Ten chances to one it is not the sermon at all, but the lights that strain your eyes, and so dull your receptive faculties. Don't blame the preacher until you have read the article on Church Lighting which concludes a series of three that have appeared in these pages.

How do you like to read in the ordinary hotel " reading room "? Often pretty tiresome, is it not? Read the article on the " Lighting of a Hotel Reading Room," and the next time you find one badly lighted put it up to the proprietor, and let him understand that you know what you are talking about.

There are a good many ways to light an office,—many of them very bad ways. " The Lighting of an Accounting Room " by A. D. Curtis is an article well worth considering. It may save you a lot of unnecessary irritation and worry.

It is worth while to know something of the basis of decorative art; it gives you the satisfaction that comes from being sure when you express an opinion. Read " The Mechanical Basis of Art in Fixture Design "; it will probably give you some ideas that are both new and interesting.

What is the finest café in the world, so far as furnishing is concerned? Competent critics say it is the Café de l'Opéra, in New York City. At any rate there are not many restaurants that hang up $50,000 pictures on their walls. You will get a fair idea of this most magnificent of New York's many restaurants on reading the descriptive article in this number.

All the subjects treated editorially are " worth considering," as usual.

You will also want the notices of the technical press and scientific societies for reference.

IF **THE ILLUMINATING ENGINEER** INTERESTS YOU, we will be glad to know why. If it does *not* interest you, we are still more anxious to have you tell us the reason. Suggestions will be most thankfully received and appreciated.

THE PUBLISHERS.

JANDUS LUXOLABRA
for THE CITY BEAUTIFUL

TALKS ON JANDUS

LUXOLABRA

For Central Station Men

The essentials in a structure which must stand exposure to the elements are *solidity* and *permanency*. A temporary or make-shift appearance is absolutely incompatible with the artistic feeling. "Enduring bronze" and "imperishable granite" are the terms that have been used to describe the proper material for exterior sculpture and architecture since the dawn of civilization.

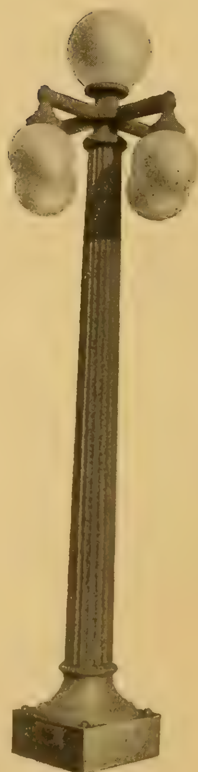
A "post" was good enough to hang a tin lantern on, but the new street lighting demands something in keeping with the progress of science and art—something to match the modern electric lamp; in a word, it demands Luxolabra.

Luxolabra are lamp standards artistically fashioned of "enduring bronze" by a new method of metal working by which the natural beauty of the metal is preserved at a greatly reduced cost; or of cement having, when desired, the appearance of "imperishable granite."

Luxolabra are built to stand for ages, *and they look it.*

Luxolabra are adapted to the new Mazda series lamps.

The Central Station that secures an installation of Luxolabra builds an enduring monument to its sense of public duty, besides adding to its revenue.



No. 35
"Savannah Standard"

Write to-day for "Catalog No. 36" describing "JANDUS LUXOLABRA." It is the most comprehensive publication ever distributed on ornamental street lighting

THE JANDUS ELECTRIC COMPANY
CLEVELAND, OHIO

NEW YORK OFFICE	PHILADELPHIA OFFICE	ST. LOUIS OFFICE	CHICAGO OFFICE
114 Liberty Street	1231 Arch Street	1120 Pine Street	23 E. Lake Street

The
Illuminating Engineer

Vol. V MARCH, 1910 No. 1

ON OUR FOURTH ANNIVERSARY

Four years ago the first copy of THE ILLUMINATING ENGINEER was issued to the public. It was remarked at the time of its first appearance that it showed no signs of infancy, but seemed to appear with the full vigor of youth. The fact is that the issue of March, 1906, was the realization of plans and ideas that had been gradually taking shape for six years previous, so it was practically six years old at birth.

Among all those interested in the general subject of illumination there was but a single individual at that time who had the foresight and prophetic vision to give a word of positive encouragement, based upon belief in the future of the publication. The general query among those to whom the project was suggested was, "What will you find to put in the magazine?" "What is there to say about illumination after a statement of the few facts concerning it?" "It might possibly furnish material for a book, but how will you keep it up?"

THE ILLUMINATING ENGINEER has indeed been "a voice crying in the wilderness," but the way has been prepared and the paths made straight with a rapidity and completeness which has astonished even the originator and his first moral supporter. The four years' work have been satisfactory beyond our most sanguine expectations. Our first object, the establishment of illuminating engineering as a distinct profession and division of applied science, is accomplished. To what extent this great achievement has been due to the work of THE ILLUMINATING ENGINEER is not for us, but the public, to judge.

The next great work is the broader field of educating the public to avail themselves of the advantages of better illumination made possible by the establishment of the science and profession.

History has shown that the people do not readily or generally seek the benefits offered by progress in science, but that they must be led up to an appreciation of them by an often slow and laborious process of education. Fortunately they are much more ready to hear and to learn now than in the past.

For the readiness with which those most concerned with the subject were converted to a belief in the cause and work of THE ILLUMINATING ENGINEER we are duly appreciative and grateful. Especially do we recognize the friendly attitude that has prevailed among those whose commercial interests were in conflict, as an evidence that of our efforts to give every form of illumination and lighting device fair and unbiased treatment.

A publication is largely what its patrons make it. We solicit a continuance of the cordial support and friendly relations of our readers, without which THE ILLUMINATING ENGINEER could not have come to its present estate.

E. L. Elliott.

The Year's Progress in Illuminating Engineering

What Has Been Done to Advance the Science Commercially and Scientifically

By E. Leavenworth Elliott.

Conforming to the custom already established, the fourth birthday of The Illuminating Engineer is made the occasion for retrospection and prophesy. Franklin says, anent the wide reputation which the philosophy of "Poor Richard" had achieved, that the greatest pleasure and satisfaction which a writer can have is in seeing his works respectfully quoted; and surely the highest satisfaction of the prophet is in having his prophesies fulfilled. The Illuminating Engineer has had a fair measure of satisfaction in both of these respects. It may not be uninteresting in view of the latter to quote the predictions made in our summary of a year ago:

> Without going into details, progress during the coming year is likely to be most pronounced in the following lines:
>
> First, the installation of better systems of street lighting, both from the decorative and practical standards.
>
> Second, more aggressive action on the part of the gas interests to maintain the present status of gas lighting.
>
> Third, more extended recognition of illuminating engineering principles in both the manufacture and sale of lighting fixtures and accessories.
>
> Fourth, the continued increase in the recognition of illuminating engineering by those largely interested in the subject of illumination, including both users of light, architects, contractors and the producers of luminants.

DECORATIVE STREET LIGHTING.

That these predictions have been very largely fulfilled is now a matter of record. The movement for decorative and spectacular street lighting has not only held the center of the stage, but has attracted attention from every part of the country and from every class of municipality, from the remote country village to cities of the first magnitude; and there are no present signs of abatement. Undoubtedly some of the installations have been conceived in enthusiasm and executed in haste, with the inevitable result that they will be more or less short lived; not that the better illumination itself will be discarded, but that systems more in keeping with the dignity of a permanent public improvement will be eventually put in. To have made the start, however, is the important thing. In one of its spasmodic reform administrations New York City had the good fortune to stumble onto a man who cleaned its streets, so that the citizens for the first time in its history had an example of what cleanliness meant, and no administration since has ever dared go back to the old conditions of filth, nor is there any possibility of such an eventuality in the future. So in the case of public lighting, once the streets have been lighted up and the citizens have had an object lesson in what modern illumination means they will never go back to the old régime of darkness and gloom.

Cities of the first class that have put in extensive modern lighting equipment are Boston, Philadelphia, Chicago, St. Louis, Seattle and Atlanta, while the installations put into smaller cities and towns are numbered by scores.

These special lighting installations form a sort of electric sign for the city as a whole. In many cases the impersonal character of this sort of sign has been supplemented by a special electric sign carrying some motto or word of welcome, usually placed near the principal door of traffic. This movement for better light is still generally being carried on through the initiative, and efforts of local boards of trade or civic organizations. At first undertaken often in a spirit of rivalry, it has now come to be more a matter of self-preservation; not in the literal sense of preventing the downfall of the city, but in preserving its prestige and reputation for thrift and progressiveness. Our first

prophecy of a year has been fulfilled to the letter.

GAS LIGHTING.

The progress predicted for illuminating engineering in the field of gas lighting has also been realized. The Welsbach Co., which by virtue of the revolutionary discoveries of the scientist whose name it bears holds the foremost place in the production of gas lighting apparatus, has established an illuminating engineering department, with one of the best American illuminating engineers at its head, and has been doing excellent work. Papers touching on various phases of illuminating engineering as connected with gas lighting have been presented at all of the meetings and conventions of the various organizations connected with the gas industry. There has been a very large accession of members to the Illuminating Engineering Society from the ranks of the gas men; there is no doubt as to the actual awakening of interest in the subject in this branch of the lighting field. Our second prediction has proven true.

THE FIXTURE TRADE.

Among the fixture trade the progress of illuminating engineering has been less marked, although by no means imperceptible. This is doubtless due to a considerable extent to the absolute lack of organization and co-operation among the manufacturers. Efforts have been made to remove this anomalous condition of affairs, but apparently without success. There is probably no other line of business involving an equal amount of capital and labor in which there is so much jealousy and suspicion as in this business of making and selling lighting fixtures. So long as each individual follower of the craft is intent on saving his own head from the blackjacks of his competitors, while figuring how he may purloin their ideas and contracts, little can be hoped for in the way of general progress in this industry. As yet no single firm or individual has appeared with sufficient moral strength and conviction to come out into the open, and follow the path of progress so clearly indicated by the march of collateral interests. Undoubtedly there are peculiar difficulties in the way which will have to be removed or ameliorated before real progress can be made. There is no doubt, however, that there has been some awakening on the subject during the past year, and as reforms generally grow in a geometrical ratio it is safe to predict that a larger amount of interest will be shown during the coming year.

ILLUMINATING ENGINEERING.

And last, the prediction as to the growth of illuminating engineering as a science and profession, and its acceptance as such by the other engineering professions and the public at large has been realized to an extent which may well cheer the heart of the prophet. Among the most conspicuous evidences of this may be mentioned:

The marked prosperity and progress of the American Illuminating Engineering Society as shown in its increased membership, stronger financial position, and the greater number and better average quality of the papers and discussions presented at its meetings.

The final organization of the British Illuminating Engineering Society, with Prof. Sylvanus P. Thompson as its president, with a role of distinguished vice-presidents.

The greater number and better quality of articles on subjects pertaining to illumination in the trade and technical press.

The appearance of several standard works on various branches of the subject by competent authors.

The greater extent to which illumination curves and other technical data are used in commercial literature.

The elimination of much of the sporadic effort to acquire or use the science without due knowledge or preparation, and a more serious, painstaking and scholarly view of the profession by those who have assumed the title of illuminating engineer.

In the development of light-sources the year has brought forth nothing essentially new. In gas lighting the inverted burner has become standard, there being no longer any question as to its successful use under average American conditions. Its application to the so-called " gas arcs " has been brought to commercial success during the year.

GAS LAMPS.

While it seems to be proven beyond question that the ramie fiber and artificial silk, or celulose, mantles are greatly superior in mechanical strength and the maintenance of candle-power to the cotton mantle which has been in general use, they have not yet become a large factor commercially. There seems to be doubt as to obtaining a sufficient amount of ramie fiber to justify its complete substitution for cotton, and the processes for manufacturing the celulose mantles have not yet been brought to commercial perfection. The mantle situation, so far as quality and uniformity is concerned, is still in a state of chaos, and is one of the subjects which is in crying need of attention by the manufacturers themselves, and gas companies, to whom the subject of mantles is indirectly of the greatest importance. It is to be hoped that before we have occasion to write another annual review we may be able to report a more satisfactory condition of affairs in this regard.

High pressure gas lighting, which has made steady progress abroad, has only been the subject of a few desultory experiments here, and there are no immediate signs of its becoming a factor in either public or private lighting installations. The question of " distance lighting," which has also reached the commercial stage abroad, has not been experimented with to any extent so far as we know.

Some very needful attention has been given to the subject of modernizing gas fixtures, and in connection with this the methods of lighting and extinguishing without the use of the bothersome match has also received consideration. The different methods of electric lighting gas burners have been worked upon, apparently with such success that very much improved and more practical forms will soon appear on the market.

ELECTRIC LAMPS.

In the production of light electrically progress has been chiefly confined to standardizing and testing out the methods already in use. The tungsten lamp is now an every day affair. On the whole, it has lived up to its promises with a fair degree of success. The smaller units, however, are not yet altogether satisfactory; and in point of uniform maintenance of life and candle-power the tungsten lamp is not yet on a par with the carbon filament lamp. As was to be expected, the use of low voltage and series lamps, which permit of the use of a much stronger wire in the filament, has largely increased. The use of lamps of this type for street lighting has shown marked progress during the year and is destined to continue, it having been shown, both by theory and practice, that they are superior in quality of illuminating results as well as in efficiency to the series inclosed arc lamps which have been so largely used.

The flaming arc lamp now unquestionably holds first place for the illumination of large spaces, whether inclosed or open. The past year has witnessed the first use of these lamps for spectacular, and in some cases regular street illumination, Newark, N. J., being the first city to put in an extensive installation of the former, and Boston of the latter kind. The type of lamp using the carbons in a vertical position and chemicalized to give a white light is being given careful trial for the illumination of public squares and open parks, with results that will undoubtedly lead to its adoption for such purposes to a considerable extent.

The regenerative flame arc has been tried out commercially to a sufficient extent to fully establish it as a valuable addition to this important type of lamp.

The metallic, or " luminous " arc, has made substantial progress by way of use for street lighting. In a number of important cases it has supplanted the inclosed arc lamp, to the eminent satisfaction of both the lighting company, the city authorities, and the people. It may now be considered out of the experimental stage, both scientifically and commercially, and one of the three types of electric lamps available for public lighting. It is reasonably certain that this type of arc will replace the inclosed carbon arc for public lighting at an increasing rate.

The titanium carbide arc has been brought out from under cover of the experimental laboratory and exposed to public view. What its commercial future is the coming year may possibly determine.

The mercury vapor lamp, while making

little noise among the more recently exploited sources, has made remarkable strides commercially. The peculiar color quality of its rays have become sufficiently familiar to render it no longer a mere object of curiosity, and the distinctive advantages which this peculiarity affords in the way of acuity of vision and softening of shadows has been given the serious consideration to which it is entitled, with the result that it has met with special favor for use in industrial lighting, a field in which it is bound to rapidly progress from now on.

The so-called "quartz" lamp, or mercury vapor lamp with a quartz tube, has been publicly exhibited, but beyond this has made no progress toward practical use.

The vacuum tube light of Mr. D. MacFarlan Moore has at last made substantial commercial progress, but in a peculiar field which it has almost created for itself, namely, that of supplying a substitute for daylight where careful color vision is a necessity. The carbon dioxide tube gives, as shown by the Ives colorimeter, a light practically the same as that from a blue sky when the sun is at a certain altitude, so that it is available as a practical supply of standard white light. It has accordingly found use in dyeing establishments and textile works where color values are of importance.

LIGHTING GLASSWARE.

In lighting glassware the year has brought forth nothing new in principle. Prismatic globes and reflectors have continued their popularity, especially for use with the tungsten lamp, and there have been numerous successful efforts to produce efficient and artistic reflectors from the various kinds of opalescent glass for similar purposes. In all cases a much better understanding of the use of a globe or shade is evidenced by a more intelligent effort to conform to scientific principles. Whereas a few years ago the photometric curve of a shade was rarely to be had from the manufacturer, it is now universal practice to put them out whenever a new form is offered to the trade.

CAR LIGHTING.

In the various divisions of the field of illuminating engineering particular progress has been made during the past year in railway car lighting, a case in which, it will be readily admitted by all travelers, there is a crying need for improvement. The Association of Railway Electrical Engineers, which was originally the Association of Car Lighting Engineers, and its official journal, the *Railway Electrical Engineer*, have both not only justified their existence, but done most excellent work toward improving car lighting. Chicago has a Car Lighting Club which includes every car lighting man within reach of Chicago, and meets on the first Wednesday of each month. Many of the important Western trunk lines have made extensive and careful experiments, with results that promise to revolutionize the present methods of car illumination. The Pennsylvania Railroad has an illuminating engineer, though he is not given the title officially by the company. The subject of car lighting has been referred to him for a thorough investigation and report. The National Electric Lamp Association maintains a department of car lighting. The lighting of the Subway cars in New York City was recently improved by order of the Public Service Commission, and it is reported that new cars when added will be lighted in accordance with the most modern ideas of illuminating engineering. It is noticeable also that four different methods of illumination are now in practical use, viz., the Pintsch gas system, electric lamps, Pintsch inverted mantle gas lamps and acetylene.

ACETYLENE.

Acetylene has been pushing ahead in the usual even tenor of its way without making much public noise. As the principal field for this luminant is in country houses, the problems which it presents in illuminating engineering are extremely simple, and therefore of far less importance in proportion to the value of the luminant itself than is the case in other modern light-sources. Lighting fixtures better adapted to the use of this luminant now seems to be the most urgent need. The old time gas fixture, while serving the purpose, is far from realizing the possibilities for decorative appearance and utility which acetylene affords, while the adop-

tion of the ordinary gas shade is still less satisfactory.

GASOLINE.

Lighting systems using gasoline and inverted mantle burners have greatly extended their business during the year. The rapid growth of this system of lighting may be attributed to several conditions, among which the greater familiarity with the use of gasoline occasioned by the automobile and the gasoline engine have doubtless contributed. Improvement in the lamps themselves and specially adapted fixtures is doubtless another important item. But probably the foremost factor has been the general desire created for more and better light. Compared with even the best of the oil lamps, a gasoline mantle burner lamp gives a far greater volume of light of much whiter color. It is worthy of remark here that the most remote country house or store can now have an illumination equal in respect to brilliancy, color and distribution to the best obtainable in the largest city, and at even less cost. Acetylene and gasoline afford to the smallest isolated installations the means of securing an illumination equal to that furnished by the largest of central stations and gas companies.

PREDICTIONS FOR THE COMING YEAR.

And now, what of the future? What directions will the march of progress take during the coming year?

Again, it seems safe to predict that the lead will be taken in the direction of better street and public lighting. While new spectacular installations will undoubtedly be quite as numerous as during the past year, the influence of these upon the general lighting of streets and parks must inevitably be felt in the adoption of improved methods. The series tungsten lamp will more and more come to replace the carbon arc in residence and outlying districts, for which purpose the arc has some well-nigh fatal faults, chief of which may be mentioned its glare, and the extreme variation in intensity on the pavement where the lamps are necessarily placed at some distance apart. If the tungsten lamp had accomplished nothing more than the amelioration of these faults in street lighting, which in many instances have amounted almost to a public nuisance, it would be worthy of a high place on the roll of improvements in light-sources. While the series tungsten lamp will not make much headway in the immediate future against installations of gas lighting already in, especially if they are equipped with mantle burners and maintained in good condition, the gas people will need to bestir themselves and make use of every improvement in burners and accessories if they are to hold their own in the expansion of street lighting systems.

For business and principal thoroughfares the metallic arc will surely come into general use, and for public squares and business centers the flaming arc will make steady gains.

Next to public lighting, industrial lighting is in line for a general overhauling. With the full return of prosperity, with its attendant necessity for overtime and double shift work, additional importance attaches to this field of illumination. The economy of providing the best possible facilities for operatives in every industry is now pretty generally recognized and acted upon. With a constant advance in the rate of wages the necessity for securing the highest possible efficiency from the wage-earner is correspondingly increased. It requires but very simple figuring to show that the cost of installation and maintenance of any lighting system is a mere bagatelle as compared with the cost of labor and value of product turned out. The various manufacturers of illuminants and accessories appreciate this fact to the full, and are making a well organized drive toward securing business from the manufacturers. The campaign of education which will be carried on in this respect during the coming year has never been equaled for comprehensiveness and concerted action in the history of the lighting industry—for which both employer and employee will in time be duly thankful.

For the first time in history a definite move toward regulating industrial lighting by legal enactment will be made, a bill now being prepared by THE ILLUMINATING ENGINEER for introduction into the New York State Legislature covering this subject, and providing that the lighting shall be subject to inspection by the proper authorities along with the other

facilities effecting the health and safety of employees.

In the development of new means of producing light nothing of a radical nature is in sight. With the number and character of scientists experimenting in this line, however, a discovery which may ultimately place all our modern methods in the shade may be announced at any time; on the other hand, another quarter of a century may pass without anything further developing than improvements in the methods of manufacture.

The progress of illuminating engineering has now settled down into a steady gait, which will surely not slacken during the coming year. It is established beyond all question or peradventure, and it only remains now to maintain a healthy growth along with the other professions.

Commercially, the coming year will probably be a record breaker in the lighting industries. Prosperity makes light hearts, and light hearts demand light surroundings.

The New Street Lighting in Newark, Ohio

By J. G. Barrett.

It's a poor State that hasn't a Newark, and Ohio is by no means a poor State; nor is the city bearing this familiar name poor in either resources or progressiveness. Newark is situated near the geographical center of the State, and is credited with having 20,491 population. It is a city of many large industrial enterprises, chief of which is the glass industry, and it is justly proud of the distinction of turning out the finest pressed glassware in the world, a claim which has been vouched for by no less authorities than the Jury of Awards of the Paris Exposition of 1900, and of every American exposition since.

Newark is of particular interest to il-

FIG. 1.—ORNAMENTAL LAMP STANDARDS, PUBLIC SQUARE, NEWARK, OHIO.

FIG. 2.—NIGHT VIEW, SHOWING EFFECT OF ILLUMINATION.

luminating engineers as being the manufacturing home of Holophane glass, which has grown from an experimental stage employing two men in 1898 to an industry requiring the entire output of a large and well equipped glass factory. It may be said to the credit of Newark's industries that it was the exceptionally fine quality of the glass tableware which it produced that led the Holophane Company to place its manufacturing department here.

Like many another "Western Reserve" town, Newark is laid out with a large public square in the business center. In this square stands the county courthouse, surrounded by a well-kept lawn now shaded with fine old elms. Following the spirit of the times, a model installation of decorative lighting was installed around this square about a month ago. The standards consist of a fluted column with four arms at the top supporting lamps in a pendant position, with a lamp in the center upright, the whole being mounted upon a cast base and finished in verde bronze. The pendant lamps are 60-watt, and the upright 100-watt tungsten, each covered with a Holophane globe. The standards are 108 ft. apart, twelve being used in the installation. The appearance of the standard is well shown in Fig. 1. The City Council is now considering doubling the number of standards, thus reducing the distance between them to 54 ft. The local lighting company has agreed to furnish current free for ten years, the city maintaining the lamps.

Even in the short time that the installation has been in use, the example has been effective to the extent that the four banks of the city have each placed two of the standards in front of their premises, and the manager of the lighting company states that they expect to place 100 more in front of business places within the next six months. They are put in on a flat rate basis per front foot of street, and run from dusk until 11 o'clock. It is also expected that the same system will be put on the principal residence avenues of the city.

That the installation is equally satisfactory to the city authorities is shown by the enactment of an ordinance making it standard, and requiring all lampposts placed along the sidewalk to be of this kind.

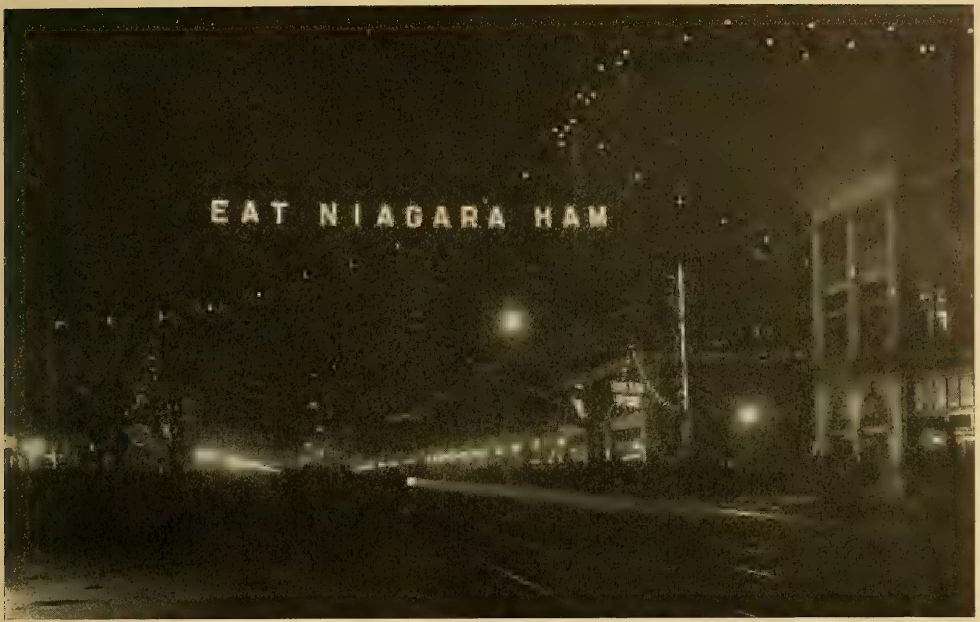


FIG. I.—CARNIVAL LIGHTING, MAIN STREET, WICHITA, KAN.

"Watch Wichita Win"

When an individual or a city says, "Watch me win," it is safe to predict that if such individual or city does not win it will not be for want of strenuous and well directed effort. The very boldness of the assertion inspires confidence. Furthermore, in this particular case, the right beginning has been made; the city has been lighted up in a modern way. It is claimed that there are more people on the principal streets of Wichita in the evening in proportion to its population than in New York City. So successful has its new lighting been that other cities far and near have used it as an example of what good street lighting is and what it can do for a city.

Fig. 1 shows the main street of the city as it was especially decorated for its carnival last September. The legend in light spanning the street in the foreground is the "outward and visible sign" of the push and prosperity of one of the large local industries, the Dold Packing Company. The letters are 3 ft. high, and are formed with low voltage tungsten sign lamps.

Fig. 2 is a view on North Main Street, the city's "Great White Way." The illumination is by multiple enclosed arc lamps, which are run from dusk until midnight. Connected on the same circuit are sign lamps used in the business district of the city. The lamps are maintained by the merchants along the street. The installation has been in use for about two and one-half years.

Fig. 3 is a daylight view of the city's sign. This, as will be seen, is a double faced sign, the letters being 3 ft. high, and contains some 500 10 volt, 5 watt, 4 candle-power tungsten lamps, current for which is supplied by a special sign transformer. A flasher is also provided, which lights the two sides alternately. The following incident related by the local lighting company is still further evidence of the "winning" way in which business is carried on in this town:

"The contract under which this sign

FIG. 2.—NIGHT VIEW OF NORTH MAIN STREET, WICHITA, KAN. "GREAT WHITE WAY."

was put up, stipulated that it should be in place for Carnival Week, which started on a Monday in September. There was some delay in the shipment of the sign, and it did not arrive here until Saturday morning. The sign was carted from the station, inspected, put together and raised in place during Saturday night and Sunday, and was burning on Sunday night. To give you an idea of what this meant, would say that the sign weighs about three and one-half tons in its present condition, and at one time during its erection there were over seventy men employed in raising it to its position on the poles."

FIG. 3.—THE CITY SLOGAN, ON DOUGLASS AVENUE, WICHITA, KAN.

The next time you hone up your razor on a Wichita oil stone—best in the world—it will be a pleasure to think what a hustling, go-ahead town bears this name.

FIG. 4.—NIGHT VIEW OF SLOGAN.

" Alternating " Illumination

By Albert Jackson Marshall

From a considerable number of observations that I have made of persons meeting in variously treated spaces where different kinds of indirect lighting effects were obtained, or where similar general illumination prevailed, I am led to believe that a great deal of "eye tire," drowsiness and other evidences of discomfort could be eliminated if the eye were exercised, so to speak, and the waste matter, which is constantly accumulating, thrown off.

I believe that all those who have conscientiously and broadly studied the subject of the effect of light on the eye are of the opinion that the eye, when compelled to operate in a space uniformly illuminated, and where, owing to the lack of different degrees of illuminations—shadows—and color effects it is unable to exercise itself, it will naturally, sooner or later, find the muscles incapable of satisfactorily performing their functions, partly owing to lack of usage.

The thought has occurred to me that if it were possible to exercise the muscles of the eye involuntarily when the eye is endeavoring to work under such conditions as previously referred to, invaluable services would be rendered. While I have as yet not had the opportunity of actually trying out this theory, I am led to believe that, from a purely theoretical viewpoint, the idea has some value, and I therefore am prompted to give it publicity, trusting that some person or persons may be in a position to experiment with it and see to what extent it possesses value.

The following experiment might lead to interesting conclusions: In a room where a uniform illumination of 2-foot candles is obtained on a horizontal plane equal to the average height of the eyes of persons while in a sitting position attach to the lighting circuit a dimming device which would vary the illumination

intensity, say from 1-foot candle to 2-foot candles, by *exceedingly minute* steps throughout a period of 15 min., so that the eye, by adjusting itself to this varying intensity of illumination, would exercise itself without the brain being conscious of such action, and observe whether this "internal massage" assists in maintaining the elasticity of the muscles of the eye and in elimination of "eye tire" and headaches, which so often result when persons are compelled to stay any great length of time in a room *too* uniformly illuminated.

Street Lighting as a Private Enterprise

Of all the arguments that have been set forth as to the value of public lighting, none is so convincing as the fact that in more than one instance the merchants and business houses of a particular street or section have contributed from their own private purses for the installation and maintenance of thoroughly modern and satisfactory lighting systems.

The illustration below shows Twenty-second street and Kedzie avenue, Chicago, in which there is an installation of this character. That the lighting is both good and attractive is shown by the crowd on the sidewalk.

The installation consists of special lampposts, each equipped with four tungsten lamps fitted with Alba glass globes and supported in a pendant position. Particular notice should be taken of the evenness of the illumination, there being no perceptible variations in intensity on the pavement so far as can be judged by the photograph; and the photograph in this case expresses the condition as it would appear to the eye.

TUNGSTEN STREET LIGHTING, TWENTY-SECOND STREET AND KEDZIE AVENUE, CHICAGO.

FIG. 1.—EFFECT OF NEW ILLUMINATION, LAKE SHORE DRIVE, CHICAGO, LOOKING SOUTH.

The New Parkway Lighting, Chicago

What the Riverside Drive is to New York, the Lake Shore Drive is to Chicago. A new installation of street lighting has recently been installed on this famous thoroughfare which is worthy of study, both from the character of the installation itself and the importance of the street which it illuminates. The purpose has been to produce as nearly as possible a uniform illumination of the roadway. This is a standard which has been declared impossible, or at least out of the question for any but such exceptionally important thoroughfares as would justify the relegation of cost of maintenance entirely to the rear.

Fig. 1 shows a view of the street looking south from North Avenue. The installation consists of concrete posts surmounted by series a. c. arc lamps of 7½ amperes, with 20-in. Alba glass globes. The photograph shows that, while the illumination is not absolutely uniform, it is so brilliant over every part of the pavement as to entirely avoid the dark spaces that are the common fault of arc lighting. That the glare of the arc has also been reduced below the point of annoyance is also shown by the fact that the globe is not lost in the halo, but shows its form distinctly in the photograph. The posts are very simple in design, but well proportioned, and have an appearance of solidity and permanence which are the prime necessities in such cases. The lamps are placed 14 ft. above the pavement, low enough to come under the branches of the trees and so avoid troublesome shadows. If the photograph is to be trusted, and it undoubtedly speaks the truth from the camera standpoint, this street is one of the best lighted parkways in the world.

Fig. 2 shows another section of the same drive exhibiting even more uniform illumination on the pavement. There have been 215 of these posts in use for over a year without a broken outer globe —a very remarkable record.

Fig. 3 is a view of the footpath along

FIG. 2.—LAKE SHORE DRIVE, CHICAGO, LOOKING INTO PINE STREET.

one side of Lincoln Park. In this case the same lamp is used, but is placed on a metal post and fitted with 12-in. Alba globes. As the posts are somewhat farther apart there are evidences of darker spaces between the lamps, but still not sufficiently dark to afford inconvenience to the pedestrians.

FIG. 3.—SIDEWALK ALONG LINCOLN PARK, CHICAGO.

Church Lighting

III

Sentiment in regard to the architecture and furnishing of churches has changed much since the Puritans and Cavaliers began colonizing the country. There has been a general tendency to discard the idea that religious worship is essentially a sad rite, and to lay more stress upon cheerfulness and optimism. A greater abundance of daylight and lighter finishings and decorations have therefore become common, and with these the necessity for a more brilliant artificial illumination has arisen. A dim light is no longer considered essentially religious.

Fig. 11 shows a mongrel Gothic structure. The lighting here is from inverted cones studded with incandescent electric lamps placed in the ceiling and three-light side brackets for gas flames. This at least has the virtue of leaving the view unobstructed and the illumination proceeding from above. If frosted lamps are used on the ceiling fixtures the general lighting may be fairly good. It certainly shows a vast improvement over the previous examples.

Fig. 12 is a modern structure of the basilica order of architecture. The light-

FIG. 11.—CHURCH OF ST. IGNATIUS LOYOLA, NEW YORK.

FIG. 12.—CHURCH OF ST. FRANCIS OF ASSISI, NEW YORK.

ing here is by a different method from any that we have previously examined, viz., by standards placed along the division of the pews. These standards are supplied with both flame gas burners and frosted incandescent lamps. The first criticism that would suggest itself here is the lack of illumination for the ceiling, which is a beautiful piece of work aside from being the natural source of light. The supporting of the lamps upon standards from the floor, however, has the advantage of leaving all the architectural elements unencumbered. So far as the illumination is concerned at the ordinary "working plane" little fault can be found, and on the whole this method of church lighting is worthy of careful consideration, as offering an escape from the serious objection to pendant fixtures.

Fig. 13 is a chapel in the Cathedral of St. John the Divine, now building in New York. The roof is a temporary structure, as will be plainly seen. The general lighting here is by large globes of leaded glass, while the special lighting on the pulpit is provided by lamps in a trough reflector, so as to shield their light from the audience. The principal objection here is that while the eyes of the audience are protected, no such protection is given to those conducting the services.

Fig. 14 plainly shows the marks of Gothic architecture, although it is a synagogue. The lighting installation here is modern, *i. e.*, much more recent than the structure. This is appropriately shown last as exhibiting a combination of all known methods of lighting, except the use of arcs. The chandeliers originally intended for candle gas burners have been decked out with electric lamps. The rest of the lighting may be considered as "outline lighting," which includes the capitals of the columns, the line of the clearstory, and the arch at the end of the building. There is surely nothing of the "dim religious" quality in this lighting, and any eye that could withstand it regularly will certainly not be dazed by the celestial glory. Our powers of criticism are quite inadequate to deal with this problem; we therefore leave it to the reader.

Having gone over nearly all the conceivable methods of lighting a church and found them all wanting, the reader may justifiably ask, "How, then, can a church be lighted? Is there no possible method of utilizing modern light sources in a manner to produce an entirely satisfactory result?"

Without wishing to claim the solution of this heretofore unsolved problem, the following suggestions are put forth for consideration. Two of the most recent forms of the electric light have never been utilized permanently for the purpose. These are the so-called vacuum tube light and the flaming arc. The vacuum tube is little known commercially, although it has been in use for some years in a small way. The normal color of the light is orange, or rather a yellow, shaded with a rosy tint. As churches are commonly provided with stained glass windows, giving a mild and more or less colored illumination by day, the color of the vacuum tube light would not be objectionable; in fact, would be rather harmonious. The intrinsic brilliancy is very low, the tube being practically free from glare. It would undoubtedly be possible to bend these tubes so that

FIG. 13.—CRYPT OF CATHEDRAL OF ST. JOHN THE DIVINE, NEW YORK.

FIG. 14.—JEWISH TEMPLE, CINCINNATI, OHIO.

they could be placed over the arches, or in such position that they would outline and accentuate the architectural structure without disfiguring it. As a light source, the Moore vacuum tube is well worth serious consideration for the lighting of churches.

The mention of the flaming arc for church lighting will at once send a shudder through the reader on the natural assumption that it would be hung on the inside of the church. This, however, is not our plan. In the August, 1909, issue of THE ILLUMINATING ENGINEER, page 295, there appeared an article descriptive of a special church illumination for a wedding. This was accomplished by hanging flaming arc lamps on the outside near the windows and screening them off with canvas. The interior effect was universally admired by those who witnessed it; and why should it not be? Of course this was an entirely temporary installation, but there is no reason whatever why a flaming arc lamp should not be hung on the outside of a window and provided with a reflector which would so throw the light as to just cover the window in a manner precisely the same as that used for illuminating billboards. The lamp would be inconspicuous by day and even by night. The interior effect would thus be the same as by daylight, especially if carbons were used giving a white light. Thus not only would the church be lighted as by sunlight, but the full beauty of the windows would be brought out, and often these are beautiful and expensive works of art. This method would be particularly available in the larger Gothic structures where there are ample windows in the clearstory. The scheme is surely worth trying.

Electric Lighting in the Maine Woods

By Geo. Wilfred Pearce.

The enormous development of fishing and game clubs in Maine, New Hampshire and the Province of Quebec has resulted in a notable expansion of the zone within which public electric lighting companies distribute rural service, and in the installation of isolated plants by rod and gun clubs composed of rich men from the large cities who spend a few weeks in summer and winter in deer and bear hunting, bird shooting and fishing.

The writer, in company with a party of engineers, some months ago made a journey through Maine to Quebec over the identical route followed by Benedict Arnold and Aaron Burr in 1775, by Washington's orders, in the expedition against Quebec. A great part of this route is through a country in which not more than ten per cent. of the land is cleared of forests, yet this party of engineers was not out of sight of an electric lighting system during more than seven per cent. of the length of the route. Some of the hunting camps in the region visited are fitted up with every luxury to be found in New York's finest mansions. A dozen of these lodges are fitted with fixtures finished in gold-gilt, silver and bronze. One lodge owner, whose place is near Moosehead Lake, Maine, has just fitted up his lodge with fixtures that cost $10,000. The current for this and many other lodges is taken from the service of an electric lighting and power company that is affiliated with the world's largest combination of wood-pulp paper makers. A superb lighting effect is produced in most of the hunting lodges owned by well-to-do people by the use of moose, caribou and deer antlers fitted up as brackets and chandeliers, to which miniature and 8 and 16 c.p. lamps are affixed. The dining hall of a fishing and gun club controlled by New York bankers and lawyers, and situated in the Rangeley Lakes section of Maine, has for its lighting fixtures twenty-four brackets in the form of lobsters, made from natural lobsters by the galvano-plastic method, and colored to the shades of green and dark red of lobsters as taken from the sea. Each lobster has in its claws three 16 c.p. incandescent lamps. The guest chambers in this club house are provided with dressing table electric lamps, the shades of which are made of polished scallop and clam shells deftly pieced together with gilt wire milled to resemble fishing lines.

The home of a multi-millionaire department store owner in the same county cost upward of $25,000 for its isolated lighting plant and fixtures. The fixtures are the usual type used in mansions in the larger cities. A novel lighting effect in the dining hall is produced by four well modeled lifesize Penobscot Indians, molded in papier mache and painted by a famous New York artist, each figure bearing uplifted in the right hand a gold-gilt eight-light 16 c.p. candelabrum.

Most of the hotels, boarding houses and stores in the forest-clad regions in which the great wood pulp companies work in northern New England are supplied with electric light generated by hydro-electric power. In a number of instances the current is carried from thirty to fifty miles for distribution to farmers and shopkeepers in and adjacent to the villages. Strange as it may appear, there are towns and villages in the heart of the most densely wooded parts of Maine which, per unit of population, make a better showing as to the use of the electric light than New York City.

Practical Problems in Illuminating Engineering

The Lighting of a Barber Shop, a Carpet and Rug Store and a Hotel Reading Room

BINDER'S BARBER SHOP, PHILADELPHIA.

Length	49′	10″
Breadth	16′	8″
Ceiling height	14′	11″

This room is lighted by 3 five-light fixtures and 19 one-light fixtures with tungsten lamps, the latter being disposed around the room, in front of and between the mirrors. The fixtures are all finished in butler's silver, the reflectors being satin finish.

The ceiling is yellow, with dark designs. The walls, wood work and chair fittings are dark, which, with satin finish reflectors, necessitates a somewhat higher wattage than would otherwise be used.

The photo shows only the first floor of a five-story establishment. The second

FIG. I.—BINDER'S BARBER SHOP, PHILADELPHIA.

FIG. 2.—CARPET AND RUG STORE, JOHN W. GRAHAM, PHILADELPHIA.

floor is given over to the ladies' department; the third entirely to children's hair cutting, shampooing, etc.; the fourth to chiropody and massage; while on the fifth is the work room, which required extra attention, because of the need for matching the color of hair and the very minute work done.

Both tungsten and inverted mantle lamps are used on the third floor, with prismatic reflectors, while the fifth floor uses gas exclusively, the inverted mantle gas lamps being equipped with bowl-shaped opal reflectors.

CARPET AND RUG STORE, JOHN W. GRAHAM, PHILADELPHIA.

Length	83′	2″
Breadth, except at front	19′	8″
Ceiling height	16′	6″

This store is beautifully lighted by two three-light and five four-light fixtures, with tungsten lamps and prismatic reflectors, with approximately 1½ watts per square foot. Though somewhat higher than many good installations, this wattage was necessary on account of the large absorption of rugs and carpets.

Each fixture has a grouping switch within the body, so arranged as to give two or four lamps on the four-light, and one, two or three on the three-light fixtures, as may be desired. This admits of the using of half the maximum illumination when showing the light-colored rugs, or on dark days when the natural illumination is inadequate.

The row of studded lamps which show in the upper corners of the photo, though formerly used in conjunction with the center outlets, have been cut out entirely since the installation of the new fixtures.

A wireman who had talked to the proprietor regarding new lighting arrangements proposed to put trough reflectors in place of the studded lamps, doing away entirely with central fixtures. Such an

FIG. 3.—LOUNGING AND READING ROOM, RITTENHOUSE HOTEL, PHILADELPHIA.

arrangement must certainly be a very severe eye strain, as it would be impossible to avoid looking at some part of same when viewing rugs shown on the floor, and certainly very much more so to one viewing the rugs draped on the walls.

LOUNGING AND READING ROOM, RITTENHOUSE HOTEL, PHILADELPHIA.

Length	38′ 2″
Width	28′ 0″
Height of ceiling	10′ 4″

This reading room is lighted by six three-light, 60-watt tungsten fixtures and Holophane stalactites and four domes, each with bowl type prismatic reflectors and 60-watt tungsten lamps placed high up in the room. The ceiling is divided by beams 2 ft. wide and 1 ft. deep, dark oak finish, into six rectangular sections or bays. One of the three-light fixtures is placed at the center of each bay. The four domes are arranged over as many reading tables, which have been placed in the center of large rugs.

The results obtained in this room were so satisfactory that as a consequence orders were given to change the equipment in the other public rooms of this house, including the main dining room, 40 x 59 ft. In two other apartment houses having together more than 700 rooms all lamps and reflectors were changed and fixtures remodeled, the work covering a period of several months. This also was directly due to the results obtained in the first mentioned hotel.

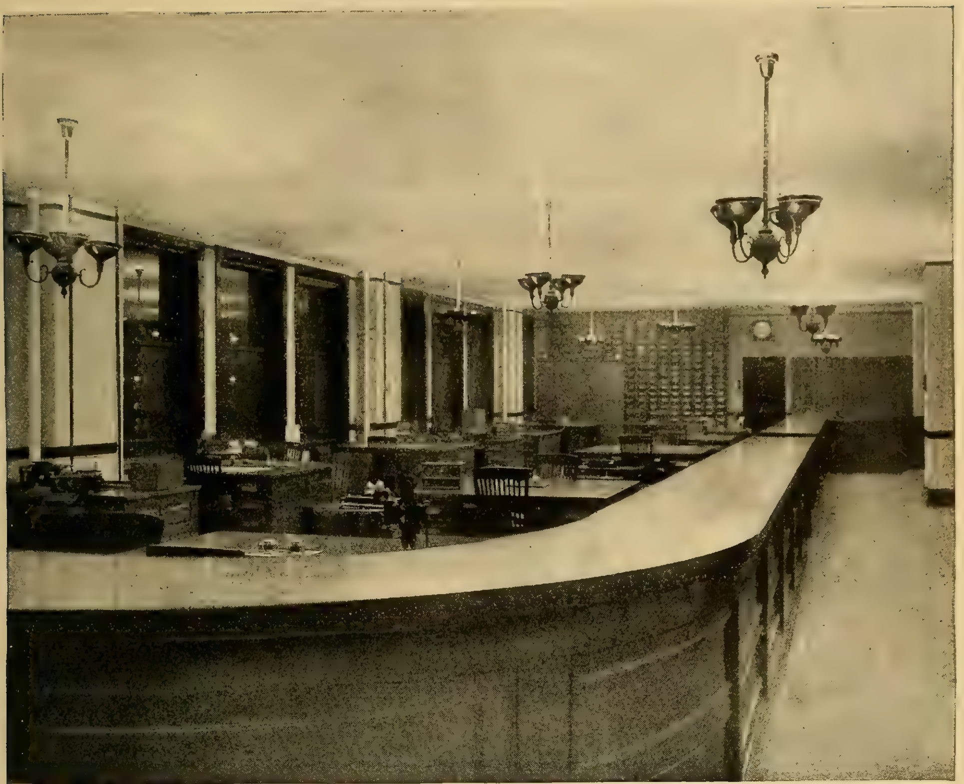


FIG. I.—WESTERN FREIGHT OFFICES, PENNA. R.R. CO., CHICAGO.

The Lighting of an Accounting Room

By A. D. Curtis.

The size of this room is 70 ft. 4 in. by 29 ft. 5 in. The former installation consisted of eleven desk uprights, each carrying two arms, or in all twenty-two 16 c.p. carbon filament lamps. In addition to these desk lights there were six four-arm fixtures on the ceiling intended for general illumination, each arm carrying a 16 candle-power carbon filament lamp, or in all twenty-four carbon filament lamps. The total wattage formerly consumed was, therefore, 2676 watts.

The six old fixtures were made use of in converting this installation into the indirect system, and two extra four-arm fixtures were placed down the center of the room at points A and B, as shown in the plan, Fig. 2. This made a total of eight four-arm fixtures. On each arm was placed an indirect unit containing the distributing type of reflector, at a distance of 2 ft. 6 in. from the ceiling. The lamps used in these units are 60 and 100 watt tungsten units, according to the amount of illumination required at any particular part of the room. The ability to vary the intensity of illumination at any part of a room, according to requirements, illustrates the elasticity of this system of lighting.

Most of the lamps used are 60 watt, about one-third being 100 watt, making the wattage in comparison to that previously used about the same.

The illumination obtained from this installation has been eminently satisfactory from the first day it was installed, affording an almost complete absence of shadows and enabling the clerks and employees of the department to read clearly

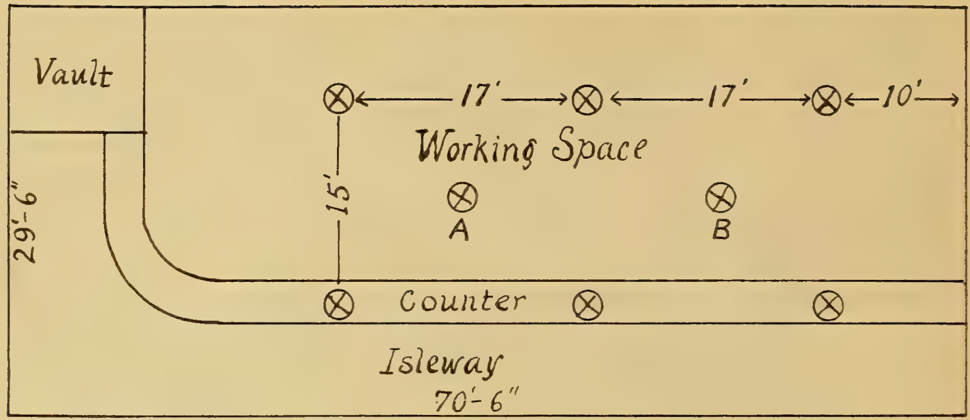


FIG. 2.—FLOOR PLAN OF OFFICE AND OUTLETS.

and comfortably, without eye-strain, all the fine print incident to this particular line of accounting, which involves railway freight bills and the various items connected with such traffic, as well as more or less indistinct handwriting.

MISSION TYPE LAMP STANDARD IN USE AT RIVERSIDE, CAL.

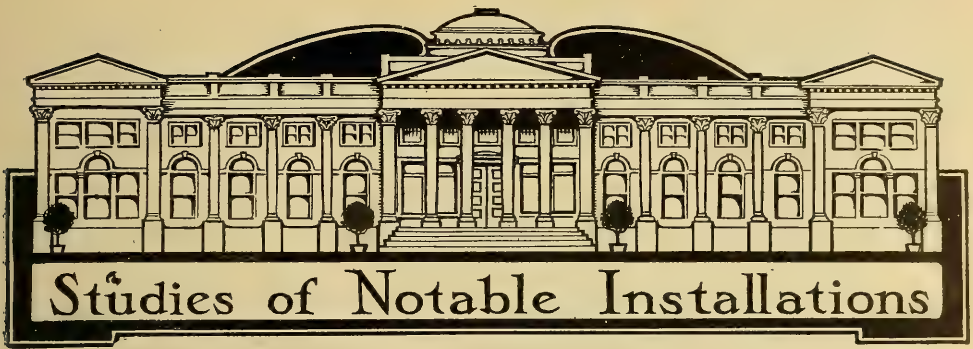
Unique Design of Ornamental Street Posts

By F. E. Collier.

Riverside, Cal., has developed a very original design for their street electroliers. The style of the post has been developed to carry out the idea of "The Mission City." Several of the public buildings are of the old mission style of architecture, and the reinforced concrete posts are therefore in keeping with the surroundings.

The posts are placed about 100 feet apart, and are lighted with two 100 watt and one 60 watt tungsten lamps. Another interesting feature of the installation is the fact that the design of the posts has been copyrighted and presented to the city of Riverside. This design can therefore be used in no other place. The building shown on the left of the photograph is a portion of the Glenwood Mission Inn.

Los Angeles, Cal., was one of the first cities of the country to adopt street electroliers for illumination of the business district, and this interesting new design of street posts very well illustrates the progressiveness of this locality.



The Cafe de l'Opera, New York City

The Most Magnificently Furnished and Decorated Cafe in the World

New York City has claimed many distinctions, the latest of which is perhaps rather characteristically American—at least it is expressed in a phrase that can hardly be called good " English "—namely, " the eatingist place in the world." With its cosmopolitan character it is possible to eat publicly, in every language of the globe, metaphorically speaking, except good, plain United States; for in all its

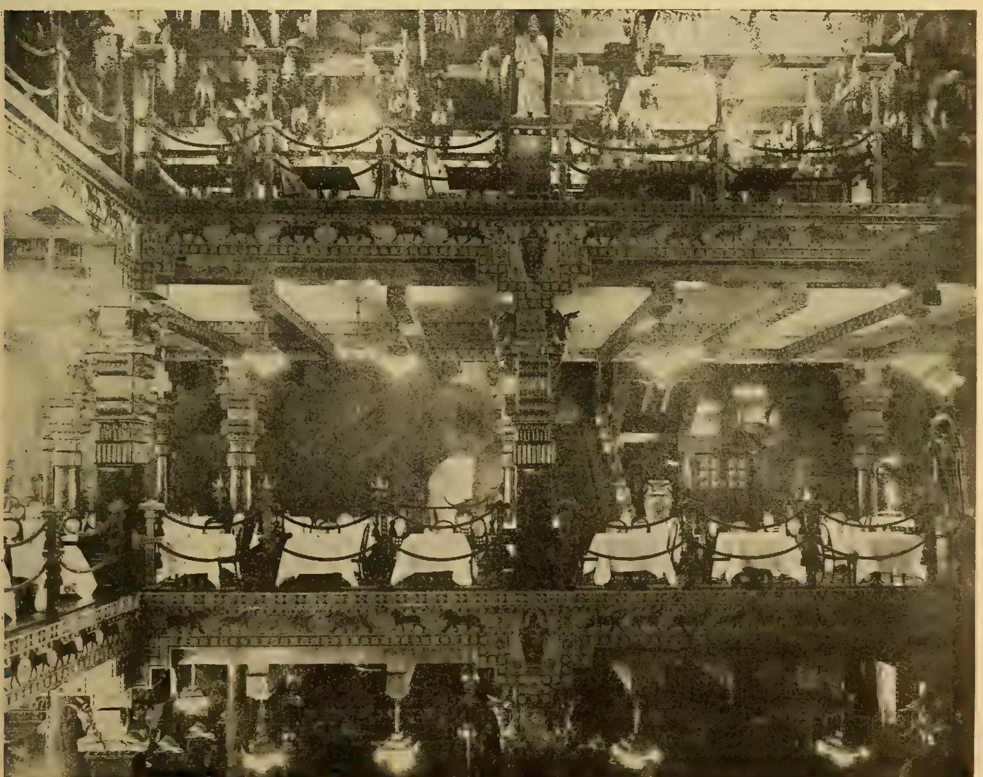


FIG. I.—THE COURT.

FIG. 2.—MAIN STAIRWAY, SHOWING FAMOUS PAINTING AT THE LEFT.

innumerable restaurants and hotels of high and low degree there is not a single one in which is served a genuine Yankee meal. While Italians, French, Germans, Hungarians, Assyrians and the rest of the foreigners can find plenty of tables set exactly as they would be in their own country, the American must be content with at most a French version of the dishes which are indigenous to his native land.

The fashionable and spectacular café naturally follows the theatre in its location; hence Times Square, which now probably includes within the radius of a half dozen blocks more theatres than exist in any other equal amount of space in the world, is the chief location of this class of eating establishment. The latest addition to this collection is the Café de l'Opéra, which occupies an entire building running from Broadway to Seventh Avenue, and seven stories in height. The building was originally a hotel, and was built in the days when gingerbread architecture was the prevailing mode. This particular school of architecture, with which the name Eastlake was connected, was the apotheosis of the adage that "beauty is only skin deep," the decorative features

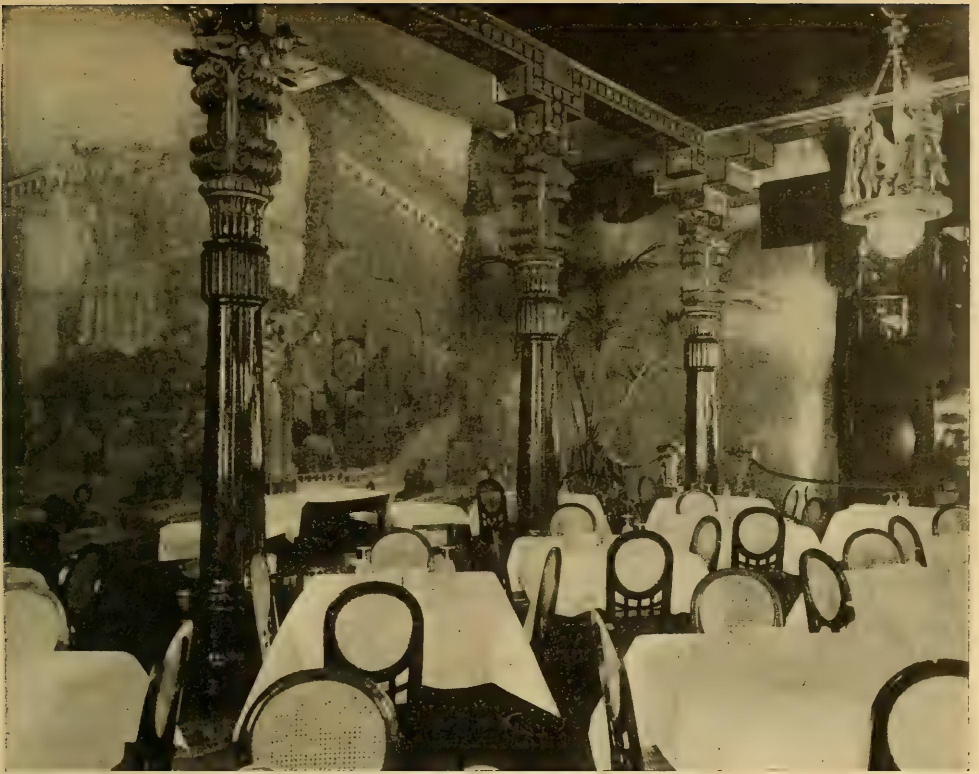


FIG. 3.—MAIN FOOR, SHOWING ONE OF THE MASSIVE CHANDELIERS.

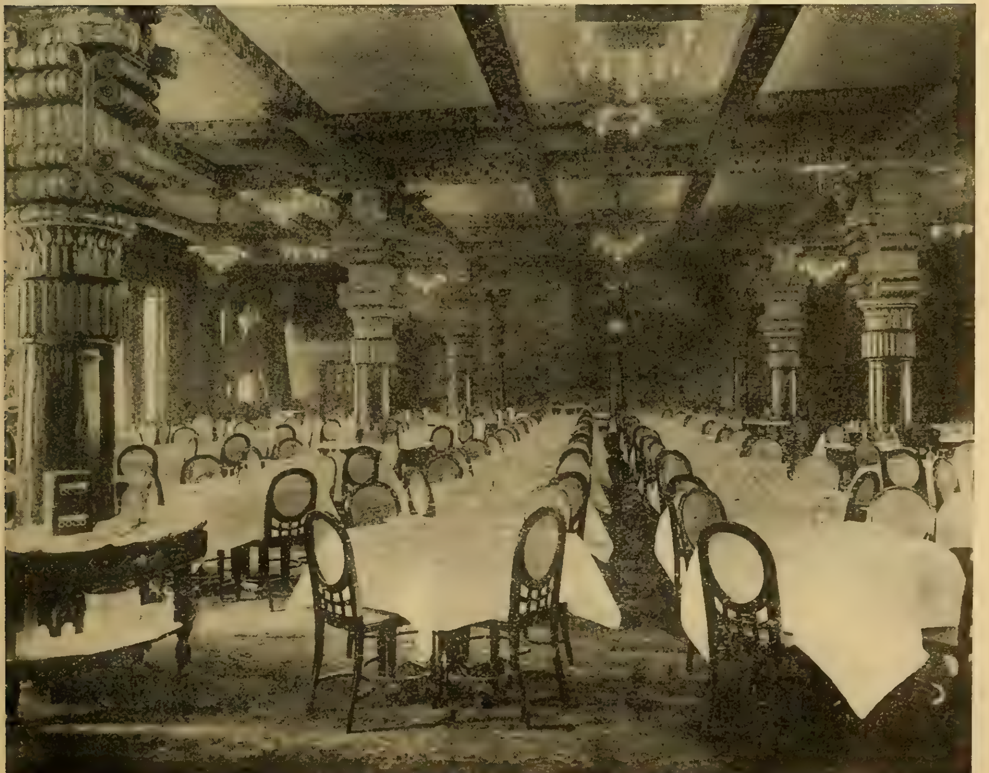


FIG. 4.—SECOND FLOOR, SHOWING ELECTROLIERS AS THE BABYLONIANS MIGHT HAVE DESIGNED THEM.

FIG. 5.—GRILL ROOM, SHOWING VERANDA EFFECT.

consisting of the most superficial and meaningless tracer of carving. To convert this into the massiveness characteristic of Babylonian times without entirely rebuilding was a feat which might well test the powers of any but an architectural genius. But the thing has been done with consummate skill, to the lasting credit of the architect and designer, Mr. Henry Erkins.

The interior decoration and furnishing have been carried out absolutely regardless of expense. The chief feature of the decoration is the celebrated painting, "The Fall of Babylon," by George Roschergrosse, which covers a canvas some 30 ft. square, and, we understand, was purchased at a cost of $50,000; while single pieces of Turkish drapery cost as much as $30,000.

A central court was opened in the building extending through three floors. The walls on one side of this are entirely of mirror, thus apparently doubling the size of the court and the surrounding rooms. A view of this court is shown in Fig. 1.

A view across the first floor, showing the illuminated fountain and giving a very good idea of the general effect, is shown on the outside cover. For the illumination of this floor large crystal beadwork globes are used.

Fig. 2 is a view of the main stairway showing a part of the famous painting at the left.

Fig. 3 is a view on the first floor showing a massive chandelier in the upper right hand corner.

Fig. 4 is a view on the second floor showing the special lighting fixtures, each of which is equipped with round frosted lamps.

Fig. 5 is a view in the grill room in the basement. The walls are painted to represent a landscape and are lighted with concealed Linolite lamps giving the effect of an open veranda.

Fixtures and Accessories

The Mechanical Basis of Art in Fixture Design

Art and science have this distinguishing feature; art appeals to the feelings, and science to the reason. The demonstration of a proposition in geometry fully satisfies the reasoning mind, but is absolutely devoid of any effect upon the emotions or the imagination; and the same is true of the steel skeleton of a building. Let the geometrical figure used in the demonstration be repeated and interwoven in tapestry or carving, and feelings may then be aroused, such as wonder, admiration, and curiosity. That which arouses these feelings is art. When the steel skeleton is clothed in brick and stone, so that it stands forth as the embodiment of a complex idea, feelings are again aroused which do not bear any conscious relation to the supporting framework. As intangible as these feelings seem to be, however, they are the result of as definite and inflexible laws as are the changes of the weather. The human mind does not act by chance, or at random, but follows its own inherent laws as rigidly as if it were constructed of wheels and springs like a clock. The only reason that the feelings seem to be entirely exempt from the ordinary laws of science is that we do not understand their action so well, nor do we take time to analyze and trace out their origin. Just so sure as the course of argument in demonstrating the geometrical problem produces invariably the same mental result, just so sure are the emotions and feelings aroused by art based upon scientific principles.

We may conveniently divide all art into two distinct divisions: pure art, and applied art. The former includes all of those cases in which the art exists for its own sake, i. e., entirely for the effect which it may produce, having no direct appeal to the reason, or utilitarian purpose. This class is often referred to as the "fine arts," which includes pictorial art, music, the drama, and to a certain extent literature. Applied art is the result of making that which is useful appeal in some degree to the feelings or emotions. This includes architecture in its highest sense, and in general all that large class which is commonly called "decorative art." Decorative art may be confined to a simple embellishment of surfaces, or it may be applied to the elements of the structure itself. Mural decoration and stained glass windows are familiar examples of the former, while the various forms of columns and other supporting parts of a building exemplify the latter.

This brief analysis of the general subject brings us to the fact that a lighting fixture is primarily a mechanical contrivance, and secondarily an object of applied art, mostly of a structural character, i. e., the structure itself is varied from the simple mechanical necessities in order to appeal to the feelings. It is a generally accepted canon in decorative art that the decoration should never interfere, really or ostensibly, with the utilitarian purpose of the object to which it is applied. This general proposition includes the corollary that the principles of mechanics must never be actually or apparently transgressed in the design of a fixture. There is a subconscious condition of the mind that takes cognizance of the fundamental laws of mechanics; and when these are apparently transgressed there is a certain feeling of distrust aroused which is contrary to the purpose of true art. *The rea-*

FIG. 1.

FIG. 2.

son must never be brought into antagonism, consciously or unconsciously, with the feelings in questions of esthetics.

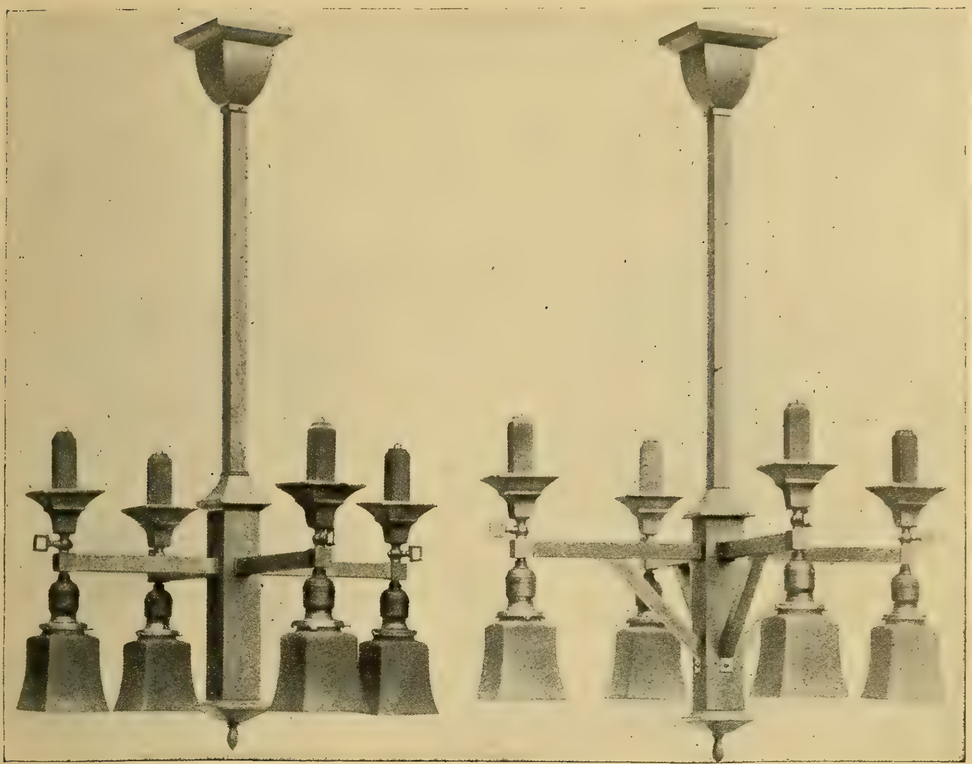
Let us take one of the simplest cases to illustrate the point. Suppose that you represent, either in picture or structurally, a person carrying a weight, such as a bucket of water, in one hand, and show the body in the usual erect position, as in Figure 1. The most untrained eye at once sees that there is something wrong; some law has been transgressed. There is a subconscious effort, as one makes continually to keep the balance in walking, to determine why this body does not fall in accordance with universal experience. Of course it requires but a little knowledge of the laws of statics to show that a person who should attempt to stand in such a position must at once fall over; the body as a mass is unbalanced; "the line of direction falls without the base," as the physicist would say.

Represent the same person leaning away from the object which he is carrying, as in Figure 2, and the eye is at once satisfied. Now, if the conditions shown in Figure 1 were embodied in a statue and bolted to a sufficiently large pedestal, it would stand secure. This actual security, however, would not have the slightest effect upon the impression of insecurity produced upon the mind by seeing the figure; there would be almost an involuntary effort to grab the statue before it should fall over.

A peculiar transgression of an equally simple natural law found its way into architecture and decorative art about a century ago. This consisted in leaving the keystone out of an arch. To make

From the Brickbuilder.

FIG. 3.



A FIG. 4. B

matters worse, the importance of the arch was generally made more conspicuous by exaggerating the structural proportions. Figure 3 shows an example of this aberration of decorative art.

Returning to the case of lighting fixtures, let us consider the structure of the commonest form of chandelier, in which the light-sources are supported at the ends of arms projecting from a central column. The mechanical necessities here are simply that the light-source with its accessory globe or shade shall be furnished adequate support. Such support may indicate complete rigidity, or it may suggest a certain degree of elasticity. Considering the former of these classes, we may examine the examples shown in Figure 4. The designs are almost purely mechanical, the artistic features consisting of only slight variations from the actual and apparent necessities of construction. The arms are, so far as the eye can observe, square bars of metal which seem to offer a sufficient degree of strength and rigidity. The portion of the central support below these arms in A is entirely superfluous; but since the supporting part above is ample this is not a positive fault, but only an excessive use of material.

B shows the same construction with the addition of substantial braces to the arms. These braces are so placed as to give the greatest possible rigidity, and furthermore create a necessity for the extension of the central support below the point of attachment of the arms. The more satisfactory effect upon the eye is unmistakable, and is the unconscious recognition of the better mechanical construction.

In Figure 5 the additional support to the arms is afforded by means of chains attached near the ends and to a point on the central support above. This would satisfy the eye as an added means of strength if the chains were taut, showing that they were actually bearing a stress.

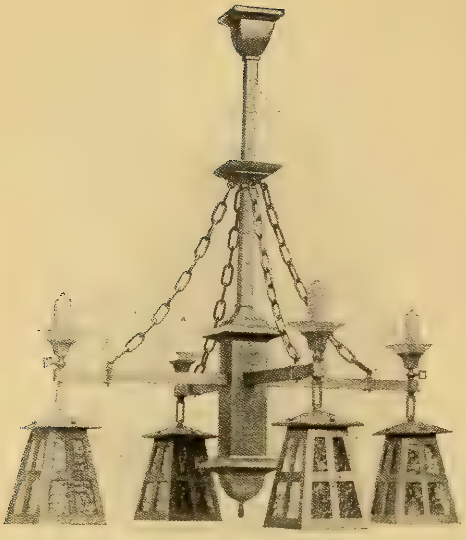


FIG. 5.

The fact that they are hanging loosely, and therefore actually affording no additional support, at once shows that they are mere appendages hung on for "effect," and consequently defeats the very purpose of their use.

Figure 6 shows a simple form of rigid construction in which the proportions are such as to satisfy the eye. The enlarged portion of the central support to which the arms are attached affords a brace, and the size of the arms is such as to give the necessary strength.

The effect of complete rigidity can be secured only by straight lines; as soon as curves are used the element of elasticity is introduced. This is plainly shown in Figure 7. Sufficient strain at the point of support of the lamp and shade would cause the arm to bend before breaking. That such is the effect intended is further shown by the supporting arms being made of a much smaller size tubing, and still further by the fact that if they were made of large tubing they would *look* incongruous.

Where elasticity of construction is indicated the form must be such as to give the highest degree of elastic limit; in other words, additional weight or strain must cause the supporting arm to bend to the greatest possible extent before breaking. Where this law is transgressed there is an effect of weakness. Thus, in Figure 7, if you should actually pull on the lamp, the arm would very soon give way at its point of attachment to the central support. An artist would call the design "weak," and the mechanic would make exactly the same criticism. While the artist uses the word as indicating the effect produced upon the senses, the cause of this is the weakness which the mechanic would at once detect.

In Figure 8 this weakness is to a considerable extent removed by turning a loop in the arm. This construction would stand considerable more distortion before giving way than that shown in Figure 7. The greater "strength" of the design artistically is apparent.

It will be appreciated without giving a specific illustration that the elements of rigidity and elasticity cannot be properly combined in the same fixture. The two mechanical principles are diametrically opposed to each other, and there must be no visible doubt as to which principle of construction is being used.

As to the choice between the two, that

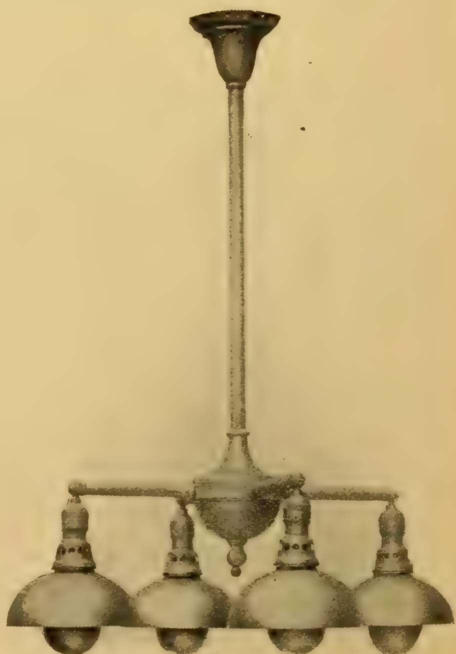


FIG. 6.

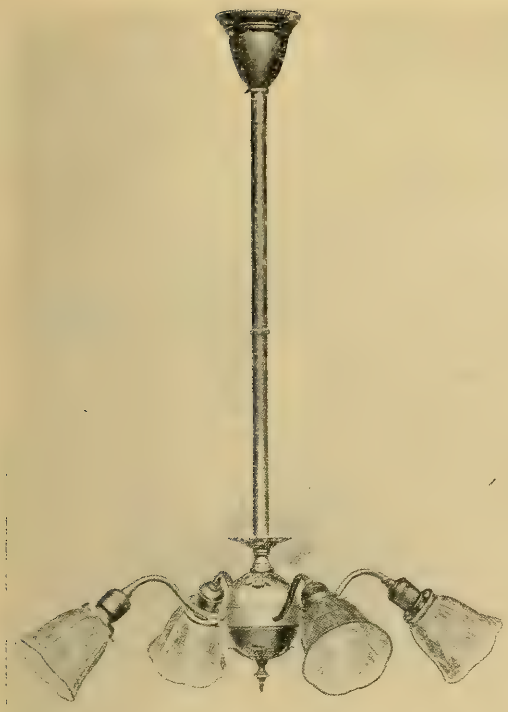


FIG. 7.

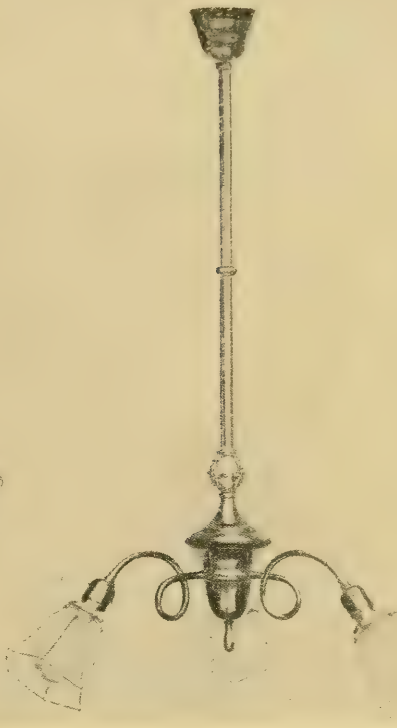


FIG. 8.

will, of course, depend upon the surroundings with which the fixture will necessarily be compared, and with which it must harmonize. In general, it may be said that rigid construction gives dignity, while elasticity gives grace. The two types may, therefore, be not unfittingly compared to the distinguishing characteristics of masculine and feminine beauty in the human form.

Where the architecture and furnishings are of a serious nature, as in public buildings, churches and mansions of the classic type, the rigid and dignified construction will be naturally chosen, as most harmonious; but where lightness and grace are the chief motives, as frequently in theatres, cafés and hotels, and generally in private residences, the elastic type of fixture is most suitable.

The elastic construction is always more complex than the rigid. Even the simplest curve which is essential to elasticity being less simple than the straight line, which typifies rigidity. Where simplicity is in itself a sufficient motive for choice, as in the case of fixtures that are in commercial surroundings, and, therefore, distinctly utilitarian, the principle of rigidity has the preference; thus, the fixture shown in Fig. 6 would be chosen for an office in preference to the one shown in Fig. 7.

Another fact in relation to the mechanical basis of fixtures which may be considered a corollary of the general proposition is, that the construction must not be greatly in excess of the demands for which it exists. The result of superfluous strength is an involuntary *reductio ad absurdum*—the thing becomes grotesque.

Illumination and Public Health

If one were to seek for the most distinguishing feature of modern theories of government, the recognition of the duty which the state owes to its citizens in protecting and promoting their health might well be taken as the example. Science, in its great battle with ignorance and superstition, has absolutely revolutionized the old ideas of health and disease. In that long period of transition, well styled the "Dark Ages," cleanliness was esteemed akin to sin rather than to godliness, and disease was accepted, not only as a matter of course, but as a divine dispensation. The darkest pages of all that dark record are those that record the frightful devastations of the numerous plagues that periodically ravaged the land. Disease to-day may be set down as due to ignorance, but with this vast difference, that it is no longer the willful ignorance of past ages, but simply the lack of knowledge covering the unexplored territory of scientific investigation.

The first law of nature is self-defense, and this becomes accordingly the first duty of the government. Defense means not only protection against external enemies, but against all internal conditions which may work injury to society. That grand word "liberty," in whose name so many governmental sins have been committed, must be used with great discretion and many limitations. The individual must not, consciously or unconsciously, be permitted to work injury to another individual nor to the state collectively. As health is only secondary in importance to life itself, the proposition that the fundamental rights of the individual involve "life, liberty and the pursuit of happiness," includes the corollary that the individual is entitled to life, *health* and the pursuit of happiness; for without the first two the pursuit of the latter is a vain chase indeed. The state, or government, is therefore not only justified, but in duty bound to see that the individual in his dealings with other individuals does not jeopardize either the life or the health of those concerned. Thus, the employer may not require his employees to work in unclean, poorly ventilated, insufficiently heated, nor, we should be able to add, poorly lighted quarters.

While the necessity for cleanliness, ventilation and general decency in the quarters in which men and women are required to work has been generally recognized and brought under the very proper domain of governmental authority, the equally important condition of artificial lighting has been thus far entirely omitted. The direct effect of improper lighting is, in a word, eye-strain, which means an undue fatigue of the nerves involved in the process of vision. These nerves form a large and important part of the nervous system, and exercise a correspondingly important control over the mental and physical condition of the subject. While most of the diseases which stalked abroad with such dire results in the past have been practically conquered by modern science, the more intangible, but no less real and vital disease of "nervousness" has been enormously increased in modern times. This is especially true among the female portion of the race, who are by nature more sensitive to nervous strain. The constantly widen-

ing field of work in which women are employed still further increases the percentage of nervous diseases. If all of the lighting systems which are needlessly and seriously tiring to the eyes were to be suddenly abolished the majority of factories, workshops and office buildings would be at once shut down for repairs.

Ignorance is no excuse when knowledge is procurable. For the numberless grossly bad lighting installations in offices and factories to-day there is positively no valid excuse. Enough is known of the hygiene of the eye, and methods are sufficiently abundant and cheap for producing a satisfactory illumination, so that there is no more excuse for unnecessary eye-strain than for any other grossly unsanitary condition. Furthermore, the knowledge of illuminating engineering is sufficiently accurate and established at the present time to render legal enactment with regard to lighting as effecting the public health as specific and effective as other laws pertaining to this important part of governmental authority. It is time that the question be seriously considered by lawmakers, civic organizations and individuals interested in the cause of good government.

Exercising the Eye

Mr. A. J. Marshall, whose contention that the present method of printing, using black letters on a white ground, is exactly contrary to the logical order, attracted considerable attention and discussion, has now come out with a theory to account for eye-strain, which he claims may result from perfectly uniform illumination. His article setting forth his observations and conclusions will be found elsewhere in this issue.

Absolutely uniform illumination, *i. e.*, illumination in which the light from every direction is equal, is known to be peculiarly fatiguing to the eyes and disconcerting to the mind. Examples of such illumination in nature are found in the light diffused through a thin fog, and the occasional peculiar effect produced when the sun is very near the horizon and its light reflected from clouds above. It is also a well-known fact that unusually long periods of continual sunshine result in nervous strain, or as the common expression goes, "gets on the nerves." Whether the nervous strain is the direct result of continuous eye-strain due to a lack of variation in the muscular tension and adjustments of the eye, as Mr. Marshall contends, or whether it is purely a psychological result due to an unaccustomed mental condition, is hard to say. There is, no doubt, however, that uniform illumination resulting from light-sources so distributed as to prevent shadows is decidedly uncomfortable in its general effect.

The statement has been frequently made by the purely theoretical illuminating engineer that the first requisite of good artificial lighting is uniformity. From the practical standpoint, this rule is subject to more exceptions than a rule for spelling the English language. As a means of accomplishing this theoretical desideratum the so-called indirect illumination, by which the entire ceiling becomes the effective source of light, has accordingly been confidently proposed as the most nearly perfect method of imitating daylight; but actual practice has shown that the desirability of the method is not free from objections, and that while having its place, and doubtless an important one, among the various systems with which the illuminating engineer has to deal, it is a long way from being the panacea for all lighting evils.

Mr. Marshall suggests as an experiment causing the illumination to gradually vary in intensity within certain limits, and noting whether such variation would not tend to rest the eyes, or at least to reduce fatigue. This at least has the plausibility of following natural illumination, which varies with the course of the sun between rising and setting, and also with the condition of the atmosphere and cloudiness of the sky.

It must be admitted that there are many causes and effects in the complicated subject of illumination which we do not yet fully understand, and all efforts to arrive at definite knowledge are of value to the science. Particularly should it be impressed upon the minds of those engaged in the practical work of providing lighting systems not to be led away by untried theories, no matter how plausible they may appear on first consideration.

There is only one court of last appeal in questions of lighting, and that is the effect upon persons habitually using the illumination. Furthermore, it is very unsafe to set down any one general rule or law to be universally followed. For example, indirect lighting is very good for some purposes and very bad for others, and so is direct lighting. Uniform illumination may be of first importance under certain circumstances, and positively undesirable in others. Light-sources within the direct range of vision may be highly objectionable under certain conditions and absolutely essential in others; and so on through the list.

It is for the reason that illumination ultimately deals with such abstruce and imperfectly understood laws as those of physiology and psychology that illuminating engineering is now, and must continue to be, very largely an art as well as a science. Attempts to reduce it to a set of simple rules which the unsophisticated can apply by following the directions is as little likely to produce satisfactory results as would an attempt to condense the *materia medica* into a list of specifics which anyone could prescribe after observing the symptoms.

Example Is Better Than Precept

When we used to write this axiom in our copybooks, with set teeth and a death grip on the penholder, we did not fully realize the numerous practical applications to which the truth can be turned. It now rises up as a valuable working rule for central stations and gas companies in their efforts to realize the doctrine, "Let there be more light."

Mr. H. W. Peck, speaking for the Rochester Railway & Light Co.—a corporation which is notoriously a disbeliever in Micawber's policy of "waiting for something to turn up"—brings out in a letter printed elsewhere in this issue the very interesting fact that better methods of illumination in the home have been largely the result of the examples set by the illumination in stores, offices and public places. With all the American's push and greed for business he generally halts at invading the sanctity of the home in his quest for orders, and so this very important field of illumination has thus far almost entirely escaped the direct efforts of the solicitor of the lighting companies. The merchant or professional man, however, who leaves at the close of his day's work a cheerfully and adequately lighted store or office and settles himself down in his home in anticipation of rest and comfort from the toil and stress of the day, only to find semi-darkness, or glaring, nerve-racking lights villainously staring him in the face, is bound to be impressed by the comparison.

Economy consists in not spending money for the things that you do not particularly care for in order that you may have it to spend for the things that you want. Luxuries are the things that you can do comfortably without. Nothing but abject poverty is a sufficient economical reason for not having the very best artificial illumination that science can produce for use in the home. Such illumination is the only true economy, and the only luxury in illumination is putting up with that which is poor. In point of actual dollars and cents lighting bills are a very small part of the total household expenses, whereas the illumination which they represent is of the very first rank in importance.

Mr. Peck's observation also suggests another familiar adage: "It is a poor rule that won't work both ways." The man who has a comfortable and efficient light by which to eat his dinner and read his evening paper will be in a receptive mood to hear the arguments of the lighting company solicitor in favor of modernizing the illumination of his store, factory or office. There are doubtless many cases in which larger results might be more quickly and easily attained by commencing with the smaller problem of lighting the home.

In either case this much is true—a really good lighting installation, whether public or private, is in itself an active force for spreading the propoganda of better illumination.

Light as a Protection Against Housebreakers

Mr. Peck also brings out another point which is worth serious attention, *i. e.,* the value of keeping one or more lights burning in the rear of residences as a protection against burglars. It is a curious idio-

syncrasy of human nature that it will use every known device to make fast the front door of the house, while leaving the rear doors protected with perhaps nothing more than the ordinary lock which can be opened with a button-hook almost as conveniently as its own key. Where the rear of a house is accessible, as in the case of detached houses, the front door is the very last place that a burglar would seek to gain an entrance. Even if there is no porch light there is usually illumination on the street sufficient to make his presence clearly visible. The rear, however, is commonly left in darkness, thus affording ample protection for the "Knight of the Jimmy." A night lamp, while not affording an absolute guarantee of immunity from burglars, is a measure of protection which is very cheap at the price.

Philadelphia Electrical Exhibition

Philadelphia has a number of historical connections with the development of electricity of which it may be justly proud. As the home of Franklin at the time of his classical researches on electrical phenomena, which resulted in the first practical application of knowledge of this subject in the use of the lightning rod, it has an enduring monument. To this must be added its distinction of having held the first electrical exhibition in this country, and probably in the world, which took place in 1884. Since 1898, however, it has not provided an exhibition of this kind, so that after a lapse of more than a decade it is especially interesting to again note its reviving this very commendable enterprise.

The present exhibition was opened on February 14 and is being held in the First Regiment Armory, on North Broad street. Special illumination of the street from City Hall to the armory has been provided in the form of illuminated arches and special signs announcing the show. The City Hall was especially illuminated on the opening night, on which occasion Mayor Reyburn touched the button which officially opened the show to the public.

Notable among the exhibits is the booth of the Philadelphia Electric Company, which occupies the center of the room. The dome of this booth is surmounted by a gilded statue of Franklin in the act of performing his historical experiment with the kite, his outstretched hand holding the cord, which is illuminated with electric lamps.

Among the other notable exhibits is the exceedingly instructive historical collection by the University of Pennsylvania.

Altogether the show is decidedly creditable to its projectors and the city which it represents.

Sweetness and Light

"The two noblest things are sweetness and light," said Swift. Taking this as a text, Matthew Arnold, the great English writer and teacher, inveighed against the tendency of his age to seek the gain of sordid wealth. Swift and Arnold were right. Sweetness and light are the two things that make life worth living; and it is a curious fact that in these United States we pay practically the same amount for each annually. Incidentally, we pay more for sweetness than any other nation on earth. The annual sales of candy amount to one-half a billion dollars in round numbers, which is, as near as can be estimated, the exact amount spent for illumination.

Notes and Comments

Good Lighting Increases Real Estate Values

THIS AT LEAST IS THE OPINION OF MINNEAPOLIS REAL ESTATE BROKERS.

Minneapolis was one of the first large cities to realize the advantages of adequate street lighting for its business thoroughfares, and to put its ideas into practice by way of one of the finest installations of the kind in this country. This was largely the result of the Publicity Club's educational work. In a booklet recently issued by this club, the following interesting facts are stated:

In the 34 blocks lighted at present as

above, there are 262 standards and 1310 lamps, with a total of 104,800 candle power.

The property owners and tenants on all the streets lighted bore the expense of installing the standards on the basis of $3.25 per running foot. The gross amount of money so contributed amounted to over $75,000, all secured by the club.

It costs practically $78 per year for maintaining each standard. This includes the electricity; keeping the standards painted; keeping the glassware in repair and turning on and off the lights three times each night. That is to say, turning on all the lights at dusk, turning off the four arm lamps at midnight, and the center light at dawn.

The plan of this ornamental lighting was undertaken by the Publicity Club and pushed to a successful conclusion, the club bearing all the incidental expense of promotion and securing subscriptions.

The actual value of good lighting, as shown by its effect upon real estate values, is thus commented upon by the *Tribune:*

That upper Nicollet avenue is on the eve of a great boom is the opinion of several Minneapolis real estate men who believe that with the extension of the lighting system, now installed as far as Twelfth street, to Grant, property will increase in value.

During the last two years this avenue has been the scene of much upbuilding. Its advantageous location with respect to the retail center and its natural beauties are said to be partially responsible for this development, but that the lighting system has been a potent factor in increasing the demand for property thereabouts is not doubted.

How Farmers Can Have Cheap Electric Light

THREE CITIZENS OF CLINTON, N. Y., SHOW HOW TO TAKE ADVANTAGE OF UNUSED WATER POWERS.

Electricity is not only going to rehabilitate the abandoned water powers of the East, but render many available that have never before been used. The following item from the *Utica Observer* contains a very valuable suggestion, and one which ought to be taken up by the agricultural as well as the electrical papers:

There are three families in the southern end of this town, namely, those of Arthur J. Barker, Frank Barker, and Clinton Trowbridge, who have solved the problem of cheap lights. By placing an inexpensive dam across the Ely brook they have secured power sufficient to generate electricity to be used for lighting the premises from cellar to garret of these adjoining farms, and it is also proposed to use the power for domestic machinery, of which there are many different kinds on the farm. Lights have been installed in all of the farm buildings and cellars and the dark places about their respective property and are used day and night. The power is cheap and the convenience great, to say nothing about the safety of such lights as compared with the oil lamps and lanterns formerly used. There is many a creek in the country where such power could be secured and where farmers could club together for installing a lighting system as well as using it for power in various ways about the farms at a very small cost compared with the benefits derived therefrom.

The Cry for Better Street Lighting Still Heard in Philadelphia

THE MARKET STREET INSTALLATION FURNISHES AN OBJECT LESSON WHICH WILL SURELY RESULT IN EXTENSIVE LIGHTING REFORMS.

Since the installation of its historic lamp-posts about City Hall, Philadelphia has been continually agog over the subject of better public lighting. The first result of this agitation is realized in the illumination of Market street, which is one of the widest business thoroughfares of any city in this country, with a modern system of lamp-posts supporting two arc lamps each. The illumination furnished is far from being spectacular; in fact, it is only ordinarily good street illumination, but so much better is it than the semi-darkness which has pervaded Philadelphia streets heretofore that it has aroused general enthusiasm.

The recent robbery of the display window of a fur store on an adjacent street has afforded another argument for better illumination. It now seems likely that the district which constituted the original city of Philadelphia may be lighted in the same manner as Market street, a movement toward this having been begun in the city councils. Beside this, some of the outlying districts are making a strong play for lighting also, notably Columbia avenue, which is an important subsidiary business center.

If Philadelphians really want to see what brilliant street lighting is like, they should put up either flaming or magnetite arc lamps on the Market street posts in place of the carbon lamps now used. They would then have an illumination worth seeing and talking about.

Albia, Iowa, to Have a Great White Way

ITS STREETS ARE TO "SHINE LIKE DIAMONDS WITH BRILLIANT ELECTRIC LIGHTS.

The smaller towns are rapidly catching on to the fact that they can have proportionately as great attractions in the way of light streets as their bigger brothers. Listen to what the *Albia Republican* has to say on the subject of lighting in this town, which has less than 3000 population:

Albia is to have her Great White Way and it is to be the west side of the public square. An arrangement has been completed with the Interurban people whereby that section of the city will be thoroughly lighted from early dusk until the late patrons of the stores have gone to their homes. Under the new lighting system the west side of the square will be the best lighted in the corporate limits of the town. Not only this, it will give that section the appearance and standing of towns ten times larger than Albia. It is thought when the new system is installed it will cause merchants on the other side of the square to follow suit.

How the Doctrine of "More Light" is Spreading

Mayor Thomas H. O'Neill, of Auburn, has left for Atlantic City to inspect the lighting system of that city. It is said that the system is one of the best in the country and as there is a necessity for the betterment of this city's system and for a system of decorative poles, the Mayor is making an investigation previous to his recommendations to the Common Council in the matter.—*Syracuse* (*N. Y.*) *Post-Standard.*

Creston merchants are planning to install a few blocks of the electrolier lights in the business portion of the city. This is one of the features indorsed by the Greater Creston Association as one good way to boost the city's interests.—*Marshalltown* (*Ia.*) *Times-Republican.*

The Rochester Railway & Light Company is planning to ornament the new Central avenue bridge with lighting fixtures in a way that will make the new structure a handsome adornment to the city. Supt. T. H. Yawger, of the Railway & Light Company, stated that among other things the bridge will be ornamented with a number of handsome fancy electric light poles with double lamps. which will be placed on every other span of the bridge, giving it an attractive appearance at night.—*Rochester* (*N. Y.*) *Herald.*

The Street Lights Committee has voted to recommend that the nine incandescent boulevard electric lights that have been maintained by the Fall River Electric Light Company for some time past for exhibition purposes, be permanently retained. The lights are 80 watt, 60 candle-power lights.—*Fall River* (*Mass.*) *News.*

A Correction

Editor THE ILLUMINATING ENGINEER,

DEAR SIR:

The February issue of THE ILLUMINATING ENGINEER, containing an article by me on "Factory Lighting," has just come to hand.

Referring to the chart, Fig. 6—Distribution of illumination on loom—page 639, I beg to call your attention to the fact that in reproducing my drawing you have omitted the descriptive matter relating to the curves. I presume you intended to include this matter in the text, but overlooked doing so.

The information which should have been included by you is as follows:

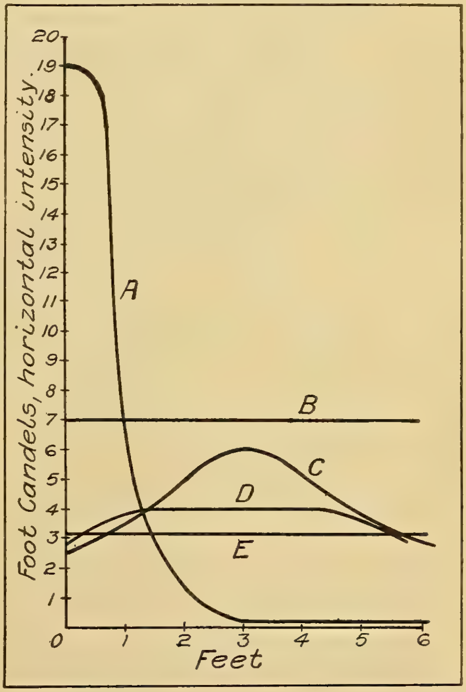
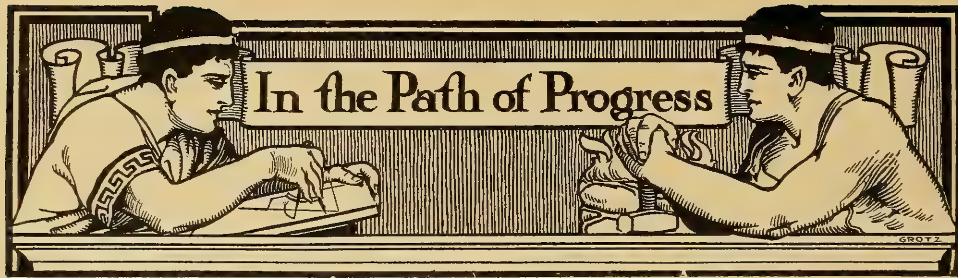


FIG. 6.—DISTRIBUTION OF ILLUMINATION ON LOOM.

A—Old Mill, drop lamps. B—Daylight, 3.00 P. M. C—New Mill, front of loom. D—New Mill, rear of loom. E—Daylight, 4.55 P. M.; minimum daylight sufficient for work.

L. B. MARKS.



General Progress During the Past Year

In order to obtain a general review of the year's progress in the lighting field a letter of inquiry was sent to a number of representative manufacturers, central stations and gas companies. The following replies have been received:

From E. N. Wrighington, Second Vice-President Boston Consolidated Gas Company:

There is a growing interest in this subject throughout the lighting world, and this interest is extending to industries not so intimately connected with the business of furnishing illumination, and in some degree to the general public.

It is gratifying to note the decrease in the number of cases of flagrantly ill-arranged lighting systems, and the constantly growing number of installations laid out according to the best tenets of illuminating practice. We have had our share of these in Boston, and the outlook for a healthy growth in this direction is very encouraging.

The inverted burner lends itself admirably to the most efficient arrangement and fills a long felt want in this regard. The Junior burners which you mentioned in your letters are chiefly suitable for residential lighting and prove satisfactory for this work. They furnish, of course, a general rather than a particular illumination and should be used to best advantage in light colored rooms, where the reflection may be used to full advantage.

It is pleasing to note the rapidly increasing amount of satisfactory glassware made for use with gas mantle lights of all kinds, and at the present time there is every reason to believe that the coming year will see a supply suitable for every requirement of art or efficiency.

From H. W. Peck, Assistant Electrical Engineer, Rochester Railway & Light Company:

We feel that the progress of illuminating engineering during the past year has been extremely satisfactory, both as to extent and as to direction. We have come into quite close touch with the local architects, advising with them on most of the important new buildings of the city. We have also received encouraging recognition from building owners and superintendents in laying out new installations and in revising old installations, and have met with a willingness to expend considerable money to obtain the best illumination. We feel that this is a real recognition of the important position of the profession and of the value to be gained by carefully designed illumination. This work has involved in most cases the use of tungsten lamps, although the field of gas illumination has not been neglected. This has also, in general, been along the lines of distributed illumination obtained from single units, although, of course, frequent occasions arise where the units are compound, comprising several lamps per unit.

Another noticeable feature has been the improvement in house lighting, which can be traced directly to the superior illumination which house owners enjoy at their places of business. This has generally come to our attention first through a complaint as to the house service, which complaint has readily been shown to be due to the inadequate illumination of homes as compared with that of the office or store. This has also afforded us opportunity to call to the attention of house

owners the value to them of lights at the rear of their homes for the purpose of burglar protection. The effect of a few 25-watt lamps at the rear of the houses in a block is very striking and the idea cannot but be recognized as one of much value to a city.

The adoption by the lamp manufacturer of the three voltage rating of the Mazda lamps has made easier the introduction of these lamps in establishments where it has been difficult to demonstrate the economy of the tungsten filament over the carbon filament on account of the low power rates.

Scientifically designed metal reflectors for use in factories have also contributed to the growth and to the greater efficiency of lighting in industrial establishments which hitherto have been a discouraging proposition.

We anticipate a large increase along the same general lines during the coming year and feel that the advantage gained by central station companies through the introduction of tungsten lamps has been very great in spite of the reduction in power consumption per unit of light.

From W. J. Grambs, Sales Manager, Seattle Electric Company:

During the year just past a notable advance has been made in the employment of electricity for street lighting in the city of Seattle and suburbs. The city has just completed its system of cluster street lighting along the principal business streets, consisting of eight cluster poles to the block, with five tungsten lamps mounted on each pole. The scheme seems to be very effective as well as beautiful.

The scheme adopted by the Seattle Electric Company for the illumination of the Alaska-Yukon-Pacific Exposition grounds proved very successful, as well as being probably one of the most effective and perfectly lighted expositions that has ever been held. For the first time a considerable number of tungsten lamps were employed by concessionaires, and where they were used the effect was very marked.

The tungsten lamp has become generally introduced, which has resulted in a greater flood of light being used by the merchants, and the show windows of business houses have been made brilliant by the use of the new lamps. The tungsten lamps are being introduced at the rate of about 5000 per month, and the outlook for the future would appear to be that in a comparativelv short time tungsten lamps will be used almost entirely for store lighting. The effect on the local central stations has not been noticeable because of the rapid growth of the city.

From Irvin Butterworth, Vice-President and General Manager, Detroit City Gas Company:

I feel that there has been some progress in Detroit during the past year in applying the principles of scientific illumination. For instance, more attention has been paid to the distance between lights and their height from the floor. I believe also that the standard of illumination has been considerably increased, more light being demanded and the users being more discriminating as to its quality and distribution. We installed a large number of so-called gas arc lamps last year, more than two-thirds of which were the inverted type. We also placed several thousand single inverted burners and expect to place twice as many this year, which shows the tendency of gas lighting in Detroit.

From J. H. De Grange, Vice-President New Orleans Railway & Light Company:

It is a pleasure for us to learn of the fourth anniversary of The Illuminating Engineer, which will be heralded by the March issue.

The Illuminating Engineer must be complimented on its fourth anniversary. Its appearance has always been neat and the papers published are invariably good and well digested and give a fund of information to all those interested in electricity.

The knowledge of proper illumination and dissemination of light has been sadly lacking and the advent of the society and the publication advocating this knowledge is progressive and up to date, for it assists materially in carrying on an educational campaign on the subject of proper light-

ing which will prove in the end beneficial to the consumer and the central station.

The tungsten lamp has come to stay and its outlook in our section is very good. It has satisfied the consumer and will please the seller of energy, and a satisfied consumer does more to encourage the use of electricity than any disgruntled one.

THE ILLUMINATING ENGINEER is a publication which is always welcome.

FROM B. W. MENDENHALL, COMMERCIAL AGENT, UTAH LIGHT & RAILWAY COMPANY:

We are pleased to state that we believe that the efforts which you and others have been making during the past few years to improve the standard of illumination has had a most beneficial result in this city. There is no doubt that this agitation has created a demand for better lighted streets, stores and homes, and that this, combined with the introduction of more efficient lamps, has raised the average illumination at least two or three candle feet.

These improved lamps have put us in a position to compete more successfully with other illuminants, so that by their aid we are able now to retain much business which was formerly lost.

The result of these various items in our case have been to increase our earnings in all our classifications, except revenue from arc lamps, at a greater rate than we have experienced for several years past.

FROM WM. J. CLARK, VICE-PRESIDENT WESTCHESTER LIGHTING CO., MT. VERNON, N. Y.:

I think that in no like period since the advent of the illuminating engineer has his art made such great strides as during the last year, particularly in the matter of gas lighting. This was markedly evidenced by the holding of a joint meeting of the New York Section of the Illuminating Engineering Society and the National Commercial Gas Association at the convention held in December. That the gas industry is waking up to the importance of this great factor in the satisfactory growth and output of its commodity is now unquestioned. A number of progressive companies have regularly employed men who are experts in illumination, and many of the gas companies who have not had their regular force of illuminating engineers are making a practise of calling in the services of these trained men in the solving of lighting problems.

The Consolidated Gas Company of New York has done a very commendable work in the equipping of a building, under the direction of an illuminating engineer, with the latest gas lighting devices. Not only does this building contain a very instructive demonstration as to what may be done in the way of the distribution and diffusion of light, but shows a clever manner of redistributing points for radiants where the gas piping in old buildings has been fixed at the time the building was constructed; the paneling of the ceiling with recessed moulding, carrying distributing pipes and conduits for distance lighting devices, is a very interesting exhibit. Having this entire building at its disposal gives the gas company an opportunity for demonstrating a great variety of lighting, such as would be useful in the home, office and shop, the latter including a very beautiful window installation. In addition to this general lighting, booths have been built by which demonstrations may be given as to the effect of various wall colorings upon the absorption and reflection of light. These booths are so cleverly devised that the layman can readily understand their meaning in the matter of working out lighting economies.

The progress made toward perfecting the inverted gas mantle burner has given the gas man a new impetus in the lighting field, and has made possible the adapting of a more sightly and ornate, as well as useful fixture, than was possible with the upright mantle burner.

I take some personal pride in having pointedly called to the attention of the gas men through my address to the National Commercial Gas Association two years ago, to the importance to the industry of the great factor of illuminating engineering, and demanded the attention of the fraternity to this important field, and I trust that my humble efforts in this

direction may have had some little effect.

As to the local situation, we are doing what we can at our employees' meetings to do some educational work along the line of proper light direction and diffusion. At our meeting in January we had an instructive illustrated talk upon the subject of burners, and with the aid of lantern slides showed the effects in light diffusion by the use of various burners, globes and reflectors. At this meeting we had some 200 employees in attendance and clearly demonstrated that this subject can be made most interesting as well as instructive.

From N. L. Norris, Secretary and General Manager, The Banner Electric Company, Youngstown, Ohio:

We find that there is an ever increasing tendency towards better illumination along scientific lines, and that purchasers who a few years ago were giving but little attention to scientific illumination, are to-day calling for expert advice on this subject. As you are aware, we have been advertising this feature for some time, and the calls which we are receiving for the services of expert illuminating engineers indicate that the people are not only thinking but acting along these lines.

From Norman Macbeth, Manager Illuminating Engineering Laboratories, Welsbach Company, Gloucester, N. J.:

The progress in illuminating engineering in the field in which we are particularly interested has been beyond our most sanguine expectations, and the outlook for the coming year is particularly bright. Whatever doubt may have existed as to the value of illuminating engineering as applied to gas sources has been thoroughly dispelled.

We have had two draftsmen and three operators on blue print machines, working continuously for the past nine months, and so far have been unable to meet the demand for flux-polar distribution curves of Welsbach lamps and glassware combinations in general use. It will take at least two months to fill all the requests now on hand for this data.

Late in December a small handbook on illumination was issued for gas solicitors. At this date the edition of ten thousand is practically exhausted and a second edition is on the press. Although no formal announcement has been made, excepting for the couple of thousand sent out on a mailing list, which, like all mailing lists has a waste paper basket at the end of the line should the man addressed not be interested in your subject, requests have been received from gas companies all over this country and Canada for additional copies. In some instances they have asked the privilege, which could not be granted, of paying for them.

The inverted lamp and its accessories has to a greater extent than the upright been made a subject of illuminating engineering study and application. You may be interested to know that the output of these lamps now exceeds 70 per cent. of that of the regular uprights which have been on the market for over twenty years. That is to say, of this company's output in lamps consuming over three cubic feet per hour, 40 per cent. are reflex.

The demand for the small upright or Junior has been ahead of the factory capacity. Numerically this output is several times greater than any other upright lamp.

There has been a very decided demand for a small inverted lamp, which the factory organization is preparing to meet at a comparatively early date.

Illuminating engineering requires that we should have a variety of lamps to properly meet the varied conditions imposed upon us by service. The day has passed, if it was ever here, when any one lamp or type of lamp could be considered a panacea for all the ills presented in the broad field of artificial illumination.

Extensive research has been under way for several months along the lines of standardization, not only of mantles, for efficiency, color and life, but of burners, to determine the equipment which will give the best results for any particular set of gas conditions, pressure, and so forth. The information secured is startling in many of its phases, and with proper application will do a great deal to advance the better kind of incandescent

gas illumination. Investigation along these lines is of vast importance to the gas industry at large and represents an enormous amount of original work, as little of the work reported in the past has been systematic.

Gas companies in the appreciation they have shown for this company's ideal—"The best for incandescent gas illumination"—have approved the farsightedness of the first gas lamp or mantle manufacturing company in the world who seriously, broadly and without reservation adopted illuminating engineering. It cannot be questioned that illuminating engineering by the gas man is a reality. The prospects for the ensuing year are especially satisfactory.

From A. H. Patterson, Vice-President, the Phoenix Glass Company, New York:

That illuminating engineering is here to stay, and The Illuminating Engineer is to be an important factor and arbiter in the installation of artificial lighting must be accepted as a fact beyond controversy or doubt.

Those associated or connected with lighting systems in years past recognize how little attention was paid either to the hygenic or practical results of lighting—resulting in too frequent cases of massiveness, unsuitableness and improper placing of the lights.

Comparing the results obtained to-day with those of a few years ago, it is indeed a most remarkable instance of progress and education. To the manufacturer of lighting fixtures much praise is due for the progressive spirit they have shown in all that pertains to design, quality and appropriateness—and, also, in recognizing changed conditions. Instead of the once massive, ponderous fixture they now produce work of high merit as to beauty, utility and design.

With the progress mentioned the manufacturers of lighting glassware have been quick to see the trend of public taste and demand and have produced shades and globes that, while possessing the efficiency desired, have incorporated in them design and character, so as to harmonize with the fixture and the decorations and furnishings where they are to be placed.

Truly, have not the past few years shown a marvelous and meritorious advancement and development in all that tends to "efficiency" in both lighting fixtures and the glassware used with them?

It is safe to believe that the manufacturers of lighting fixtures and their allies—the manufacturers of lighting glassware—will continue this good work in their respective lines, their future productions showing further advancement and progress, thus testifying to their untiring energy for still higher achievement and the success they deserve and bring.

Just here permit me to cite a practical instance of results quickly reached: After a most careful study, application, patience and perseverence the Phoenix Glass Company presented a line of lighting glassware—their "Pheno"—possessing beauty as to design and high efficiency as to results, a combination of the practical and beautiful, that has already been highly praised and very successful.

From Clare N. Stannard, Secretary, the Denver Gas & Electric Co., Denver, Colo.:

In discussing the progress of illuminating engineering work with our illuminating engineer, Mr. C. F. Oehlmann, our conclusions are about as follows:

In this territory will say that we believe the advent of the tungsten lamp has enlarged the field of illuminating engineering to a very great extent.

The possibilities for various kinds of illumination with the tungsten lamp varies so greatly and conditions are so different that illuminating engineering work has become a problem that will occupy much more time and work than was necessary with the old carbon or arc lamp.

Our own service supervisors and representatives have seen this condition and find that it is desirable to take up the study of illuminating engineering. For the first two years our class numbered five or six and never more than eight, but now we have a class of fourteen, all taking a great interest in illuminating engineering. Outside of the office we find architects and builders who are very much interested. We also have people coming from out of town asking for information.

As to the new type of tungsten lamps,

we have had so little experience that I am not able to say much about them at this time.

FROM HARVEY S. TONKS, SECRETARY, ELMER P. MORRIS COMPANY, NEW YORK:

Regarding the progress of street lighting in this country, we are glad to be able to state that the interest has been greater than ever before and the question of quality has been the paramount issue rather than price.

During the fifteen years of our experience in manufacturing posts for public and private street lighting, no one year has brought us as much business as the past, and it will be necessary for us to double the capacity of our factory to provide for the orders on hand for 1910.

We believe that the work being done through your columns has been an important factor in this result, and trust that your slogan, "Let there be more light," will reach to the far corners of the earth, for this is the field we cover.

FROM ALFRED D. CHILDS, ASSISTANT TO GENERAL MANAGER, COOPER HEWITT ELECTRIC COMPANY, NEW YORK:

Selling its product almost entirely to industrial plants, the Cooper Hewitt Electric Company, New York, felt early in 1909 the renewal of commercial activitiy, and the demand of the Cooper Hewitt lamps was particularly well sustained during the first six months of the year. Experience has shown that in the curve showing shipments there is normally a continual drop from the peak of December to the low point of May. In the early months of 1909 continued demand for new lighting equipment from the steel and tin plate plants and at the same time the release of held orders for railroad shops and textile mills carried the low point in the curve far above the average reached in the previous May. From the first of June business increased rapidly and the peak for the year was run over 30 per cent. beyond the previous high water mark.

This increase in the demand for Cooper Hewitt lamps was due without doubt to the renewal of business generally. But at the same time it was directly traceable to the recognition given to the lamps by superintendents, engineers and finally by that court of final appeal, the men at the bench and at the loom, who quickly realized the quality and value of the light for their own particular work. To this now recognized quality was added the electrical efficiency and the demonstrated economy in the cost of maintenance.

Second in consideration to the quality of the light is the cost for current and maintenance. The current is easily measured, but final proof of low maintenance was made summing up just exactly what some eight thousand lamps had cost for new tubes, and the figures per lamp per year show that the most optimistic assurances of the manufacturers have been outdone.

Increasing in its first field (which includes machine shops, steel mills, drafting rooms and foundries) the Cooper Hewitt lamps, during 1909, became established in the textile mills, through the showing made the year previous in the silk mills and by demonstrating the fact that the changes in the color values were not important, and that that quality which makes for value in the machine shop obtained in an increased quantity for the textile industry.

The establishment of a commercial alternating current lamp was an event worthy of note, as was also the introduction of an automatic tilting lamp with two tubes instead of one. Another improvement in the standard lamps was the introduction to the auxiliary or lamp body of a sliding resistance which makes the lamps readily adjustable to all commercial circuits.

With the increase of manufacturing all above the line and with the growth of illuminating engineering and the applications of its practices to industrial plants, the outlook of the current year as well as the figures for the first two months all point to the smashing of all previous records.

FROM E. N. HYDE, ASSISTANT TO GENERAL MANAGER, THE HOLOPHANE COMPANY, NEWARK, OHIO:

In October, 1905, the Holophane Company published a loose-leaf book of a size easily carried around in the coat pocket.

This combination data book and catalogue marked the first commercial attempt ever made to place before those interested in lighting problems knowledge which could be of practical value in predetermining the illumination obtainable by combining prismatic globes and reflectors and certain electric incandescent lamps or certain gas lights. From that time down to the present probably no industry has grown more rapidly nor has any manufacturer attained a more enviable reputation in the field of illumination than has this company.

Since 1905 many improvements and advances have marked the progress of incandescent electric lamp and gas mantle manufacture. The use of the mantle in an inverted position and the wide introduction of tungsten filament lamps have resulted in the broadening of the field where Holophane glass is used, and the Holophane Company, by keeping abreast with the times, has grown to wonderful proportions. It has extended the market for its product until in the United States and abroad Holophane is fast becoming a household word, meaning efficiency and economy in lighting. Five years hence there will be still greater achievements, and with the educational campaign of the past continued we have reason to believe that the Holophane globe or reflector will be as much in demand as are light giving appliances themselves.

Through the medium of the daily papers, the universities and the technical press, Holophane methods of engineering and Holophane prismatic control of light have become well known, and the sound principles of the former and the effectiveness of the latter exploited. We recognize the benefits thus derived and take this opportunity of expressing our gratitude.

THE ILLUMINATING ENGINEER deserves special praise for the splendid work it has done to supplement commercial effort with technical and practical knowledge, and it has our unstinted praise for the great good it has accomplished in advancing the art of illumination.

FROM LORIN W. YOUNG, EASTERN MANAGER ILLUMINATING SPECIALTIES DEPARTMENT, MACBETH-EVANS GLASS COMPANY:

About a year ago for the first time reflectors of Alba glass were offered to the public, being then one of the "new products."

Conceived originally as a triumphant addition to decorative lighting effects, the acceptance of these by those principally interested in artistic illumination was immediate.

An instance of what the illuminating engineer has accomplished within the last few years was, however, perhaps never better illustrated than in this case, for shortly numerous requests were received by their producers, the Macbeth-Evans Glass Company, asking for data showing what these new reflectors would do, aside from the beauty they would add to an installation of high efficiency units.

In the tests resulting from these inquiries some qualities were found to be even better than was originally supposed, and in all the establishment of this line on a plane with other lines whose powers were also accurately tabulated has been of extreme benefit and has gained for it many new friends.

Among other things, these tests have proved that this glass could be adapted to the use of inverted gas burners with very pleasing results. The line being now an accessory to the two great luminants, the coming year should bring to its makers a degree of business commensurate to their success in the past year and their sincere endeavor to make of this line one of the high-class products of its kind.

FROM T. I. JONES, GENERAL SALES AGENT, EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN:

As to what progress illuminating engineering has made in our field during the past year and the outlook for the coming year with reference to the newer types of lamps, we take pleasure in advising you that the year 1909 was the largest year in the company's history in the matter of new business written and the number of 50-watt equivalents added to the company's system, both in light and power. Nearly one-quarter of a million equivalents were added during the year 1909. In the last three months, in the year 1909, an increase of nearly 100 per cent. in business written over the same period in 1908 was made.

Since the advent of the tungsten lamp the Tungsten Lamp Specialty Company, operated as a branch of the sales department of the Brooklyn Edison Company, has taken contracts for and wired over 1800 installations formerly lighted by oil or gas. This is one direct result of the introduction of the new type of illuminant.

We are continuing to take contracts for unwired premises at the rate of ten to twenty contracts per week. In all of these cases the gas or oil illuminants are being replaced by the Mazda lamp.

The outlook for the coming year is an especially bright one for us. January was a good month and we anticipate a very large increase in our connected equivalent during the coming year.

With the reduction of the price of tungsten lamps which the larger companies expect to make in the near future the growth will be even more great than in the past, as through this reduction the cost of lighting to the average consumer will be materially reduced and he will have a higher type of illuminant, more efficient, more economical, and more attractive than ever before.

From H. M. Hirschberg, President, the Excello Arc Lamp Company, New York:

The use of the flaming arc lamp has expanded very largely within the past year. Its chief advance has been in the lighting of large works, docks and yards, and wherever construction work is carried on at night. It is not too much to say that in this latter field the flaming arc has been revolutionary in its effect in facilitating night work. With the return of general prosperity the demand for this kind of work has increased, and this increase has beyond question been augmented by the efficiency with which it can be carried on under the artificial light such as furnished by the flaming arc lamp. With this illumination there is practically no difference in the results of the night and day shifts.

The demand for lamps for industrial purposes has been so great as to tax the capacity of the manufacturer, so that less attention has been paid to extending the use of the light for public lighting than might otherwise have been done. Nevertheless, as the public grow familiar with its advantages, and as the demand for better public lighting becomes more general and insistent, the flaming arc is sure to be used more and more in this field. We have just brought out our new "Axis" lamp, in which the carbons are in the vertical position, thereby giving the wide distribution essential for the best results in the lighting of streets and open squares. This lamp is now being tested out in several large cities for this purpose, and when the authorities have satisfied themselves of its undoubted advantages its installation for this class of work must inevitably follow.

The Excello Flaming Arc Lamp has increased in sales and in popularity since we first introduced it in this country five years ago at an unprecedented rate, a rate which could only have resulted from actual merit; and, although the sales have become large, so far as actual use is concerned the lamp may as yet be said to be in its infancy. The coming year will doubtless surpass all preceding years in volume of business.

From L. D. Gibbs, the Edison Electric Illuminating Company, Boston:

Definite and satisfactory progress has been made during the year in the illuminating engineering field by this company. The marked appreciation shown by the company's customers when a department of commercial illuminating engineering was opened two years ago last autumn proved conclusively that there was a broad field here in which to work for the mutual advantage of the company and the people. While the work was not so actively pushed last year, because the company believes that after a branch of the business has been placed properly before its customers that thereafter it is a settled part of the organization's work, the results were no less satisfactory. People now take it as a matter of fact that the company's representatives will give expert advice on the best arrangements for illuminating stores, factories and homes. This branch of the business marks a distinct advance of the electric lighting field, just as the substitution of steam turbine

generators for the old types marked an advance. People now want not only economy in lighting bills, but efficiency in illumination. They like to feel that, as has been said by enterprising advertisers, they can have more illumination without having to spend money for more light. The slogan, "The same light for less money or more light for the same money," while not exact in its phraseology, is appreciated on its merits by those who are using the modern illuminant.

The Edison Company has not yet noticed that the adoption of the trade name Mazda has tended to popularize the high efficiency lamps. This may be due to the fact that the Boston Edison Company's territory, consisting of thirty-two cities and towns besides Boston, is well supplied with the high efficiency lamps. People are everywhere familiar with them, and thousands can talk as fluently about their efficiency, economy, fragility, etc., as can the salesmen themselves. There used to be a widespread impression that Boston and its environs was populated with "slow" people. Those who have kept in touch with advances made there have changed their minds. No section of the country adopts *real* improvements more readily or thoroughly than eastern Massachusetts.

The outlook for the coming year is pleasing. The Boston Edison Company's motto, "A pleased customer makes ten," is working like leaven. The company is just now concentrating its efforts in a personal canvass of its customers with a view to improving everywhere possible the conditions under which electricity is used. This will mean the rearrangement of lighting in thousands of places and the introduction of many tungsten lamps. This work on the company's part means the practical application of principles of illuminating engineering, and the combination must result in the still greater use and appreciation of electric light.

From F. J. Low, Advertising Department, H. W. Johns-Manville Company:

The remarkably rapid rate at which illuminating engineering has been accepted by the users of light has been well shown in the demand for special devices for special purposes. The old idea that anything that would give light "would do" is very rapidly being supplanted by the new scientific idea that only the best is "good enough." It is on this basis that the Linolite System of Lighting has been developed. Our work during the past year has been chiefly directed toward adapting the tungsten filament to the Linolite lamp, and it is a just cause for satisfaction to ourselves that we have succeeded in accomplishing this purpose to a very high degree of success, thus rendering the advantages of higher efficiency and whiter light available for this system of illumination. Particularly pleasing has been the remarkable life of the tungsten filament Linolite lamp and its freedom from mechanical breakage, in both of which respects it far exceeds the older form of carbon filament lamp. The question of reflectors for the various uses for which this type of lamp is especially fitted has also been carefully worked out.

The lighting field is so extensive that any device which is admittedly superior for even a small part of the total number of problems presented is insured a sufficiently large patronage to justify the most thorough attention to its perfection and commercial exploitation.

With perfected apparatus, and a constantly widening appreciation of the necessity of choosing the very best for each individual problem, we look forward to a greatly increased demand for Linolite during the coming year.

"Consider the Lilies"

The approach of Easter naturally suggests the beautiful emblem now so largely used in commemoration of this season, everywhere known as the "Easter Lily." The popularity of this flower in connection with this festivity of the Christian church is due to its commonly bearing three blossoms upon a single upright stem, giving it thus the form of a cross. The beauty of the symbolism is still further enhanced by the spotless purity of the white blossoms. Assuredly it is no profanation of this sacred emblem to give it a form that is self-luminous, thereby adding a still further symbol that is peculiarly fitting in reference to the one

THE EASTER LILY.

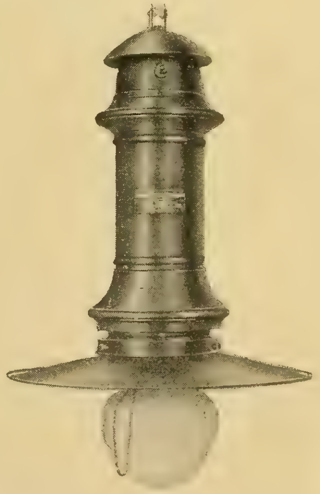
who is called the "Light of the world."

A design made to almost exactly simulate the living Easter lily, provided with a small electric lamp in each blossom, is offered by a firm in New York who make a specialty of these electrical decorations and emblems—Gudeman & Co., 24 West Thirty-third Street. On account of the intrinsic beauty, as well as the special symbolism of this, their latest conception, it must inevitably reach a large sale. The general appearance is shown in the above illustration.

A New Arc Lamp for Both D. C. and A. C. Current

The small carbon enclosed arc lamp has at last justified its existence, if satisfied customers may be taken as a proof. To make a lamp of this type generally available, however, it is evident that it must be adapted to both A. C. and D. C. current. The problem of the multiple lamp to run on D. C. current is comparatively simple; to make a small carbon lamp run on A. C. current is quite another matter, and to make one that will run equally well without any change in adjustment on either current is a still more difficult problem. The Sunray Electric Lamp Mfg. Company, 109 West Forty-second Street, New York, seems to have solved even this last problem successfully. While their lamp has not yet been regularly offered commercially, a few trial installations have demonstrated its practicability. Their new A. C. lamp has the same neat exterior appearance as their D. C. lamp. The same simplicity and thoroughly good mechanical and electrical interior construction is also used.

There are cases where D. C. current is used in the day time from an isolated plant and A. C. at night from public service mains. In such cases the convenience of having a lamp that will work equally well on either is manifest, and this the Sunray lamp seems to do. The lamp when intended for such use is fitted with a resistance coil. When intended for A. C. current only an extremely small and compact reactance coil is used for greater economy. The lamp thus far has shown a life of from 35 to 40 hours on one trim and is absolutely noiseless in operation. While naturally somewhat less efficient than the D. C. lamp, it is still of a very high efficiency for an A. C. lamp. The excellent record made by the D. C. lamp put out by this company seems destined to be repeated in this later product.



THE NEW A. C. SUNRAY ARC LAMP.

Proceedings of Technical Societies

British Illuminating Engineering Society

The subject of "glare" was discussed at the January meeting of the Illuminating Engineering Society in London.

It was pointed out that the meaning attached to the word "glare" by different people varied very greatly, and there was a need of definite ideas as to what exactly could be described as a "glaring" system of lighting and considered objectionable. In particular it was thought desirable to attempt to collect information as to the best methods of utilizing the newer and brighter illuminants in interiors so as to avoid "glare."

With this object a series of eleven questions were circularized among members of the society previous to the meeting. Some of these were more or less physiological in character. Others dealt with such questions as measuring glare, the desirability of fixing a maximum brilliancy of sources used in interiors, etc.

In opening the proceedings, however, President Thompson, of the society, explained that the wideness of the subject rendered it impossible to treat the whole ground in one evening. It had therefore been decided to keep to the more physiological aspects of the subject and to deal with the remaining points at the next discussion.

The discussion was opened by Dr. J. Herbert Parsons, whose remarks clearly showed that, even among physiologists there was much still to be learned as to the nature and cause of the sensation of glare.

Dr. Parsons prefaced his address by a short explanation of the structure of the eye, and pointed out the great importance of the retinal processes as a means of explaining problems of illumination. For example, whether or no the illumination in a room appeared painfully bright and "glaring" or not depends to a great extent on the previous history of the eye. If a person has been in dark surroundings his retina adjusts itself thereto and at first brighter surroundings are disagreeable. Yet it might be incorrect to term such surroundings "glaring," since the eye would gradually become accustomed to the new conditions and presently find them quite satisfactory. Of course such an effect as this varied in individuals.

In some cases, also, we termed a light glaring because it came from a peculiar direction, for example, the reflected light from the sea or a wet road, or even a highly glazed paper. Dr. Parsons also alluded to the suggestion that a simple means of detecting glare might be found in the behavior of the pupil aperture. However, he himself thought that it would not furnish a very reliable test.

Dr. Parsons also mentioned that in some cases glare was considered to be connected with the color of the light. It was of course recognized that different qualities of light might act differently on the eye. For example, the ultra-violet rays were known to exercise peculiar effects. But this was really a separate question, and he thought that "glare" should be regarded as a function mainly of luminosity and not color. President Thompson then called upon Mr. J. S. Dow to read an abstract of a few of the most important points in connection with communications from corresponding members, pointing out, however, that these contributions to the discussion were far too comprehensive to be adequately treated in the time available.

Summarizing the opinions of these au-

thorities, Mr. Dow remarked that the general opinion seemed to be that "glare" ought to be taken as connected mainly with *excessive brilliancy* or *contrasts.* Yet there seemed to be difference of opinion as to which of these two factors was the most important. Dr. Stockhausen, for example, defined an illuminant as glaring when the image of it focussed upon the retina was so bright that the visual material was used up quicker than it could recuperate. Prof. L. Weber, of the University of Kiel, however, thought that a limit to the intrinsic brilliancy of an illuminant alone was not enough. It was also needful to prescribe that its brightness should not exceed that of its surroundings by more than a certain amount. There was also some discussion as to whether unscreened sources of great intrinsic brilliancy should be entirely excluded from interiors of moderate dimensions. One authority stated that the permissible intrinsic brilliancy of a source in a room should be zero. In other words, it should never be possible for the eye to receive direct rays from the source of light. In other cases it was suggested that naked lights might without objection be used provided they were hung high up, out of the range of vision.

In the further discussion at this meeting Dr. Edridge Green emphasized the variation in different eyes, remarking that his own were exceptionally sensitive to violet light. He also pointed out the importance of supplementing physiological experiences by physical measurements. For example, the eye was often quite deceived as to the illuminating power of two sources of light; indeed, it might even estimate one source to be brighter than another, though, as a matter of fact, it proved when tested photometrically to give very much less light.

Dr. F. Gans discussed snow blindness as an example of glare. He thought, however, that this effect could not be ascribed solely to the effects of ultra-violet light. For example, Dr. Best had shown that the eye could, for a certain period, look steadily at the sun through a glass which allowed only ultra-violet rays to pass without subsequent discomfort.

Dr. James Kerr, medical officer to the L. C. C., pointed out that many different effects were classified under the general heading of glare. For example, there was the high intrinsic brilliancy of modern sources of light, but there was also the quite distinct effect of misdirected light. He knew a case of the eyes of school children being troubled by light coming in the wrong direction from misplaced prismatic glass in the window; owing to the intensity of the light thus badly distributed there was a marked decrease of visual acuity.

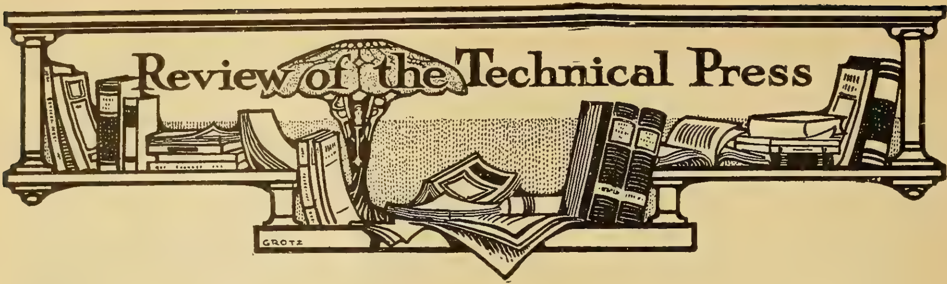
Dr. Legge, of the factory department of the Home Office, also spoke, laying stress on the need for recommendations on the subject of excessively bright illuminated signs.

In closing the discussion President Thompson remarked that if the society could succeed in definitely framing a definite statement as to what constituted glare it would be a very useful piece of work. He then announced that the discussion would be adjourned till the next meeting on February 15, when the more familiar applications of physiological principles to practice would be dealt with.

American Illuminating Engineering Society

At the February meeting of the New York section a paper was read on "Public School Room Lighting," by George W. Knight and Albert J. Marshall.

The paper treats of a number of careful experiments that were made in one of the public schools of Newark, N. J., Mr. Knight being the supervising engineer to the Board of Education of that city. Different systems of lighting were installed and measurements made of the resulting illumination. A lengthy and general discussion of the subject followed, in which some very interesting points were brought out by Mr. Hatch, whose work on illuminating engineering for the Boston public schools is well known. Experience in the Newark school showed that three and a half foot-candles intensity was satisfactory to both pupil and teachers, but any material reduction below this point met with protest. An illumination as low as two foot-candles, however, has been found acceptable in Boston.



American Items

NEW BOOKS.

"Illumination and Photometry," by William Elgin Wickenden, B.S. 190 pp., cloth; illustrated with diagrams. McGraw-Hill Book Company, New York. $2 net.

The material of this book is the outcome of a course on illumination and photometry given by Professor Wickenden at the University of Wisconsin. As might be expected from a book intended as a text for the use of students in the advanced years of college work, the treatment is distinctly technical. Higher mathematics are freely used whenever a subject is capable of mathematical treatment. For the particular purpose for which the book is intended—viz., as a college text-book—it possesses the advantage of being up-to-date, and of treating the pure theory of the subject in a clear and sufficiently comprehensive manner. For the practicing illuminating engineer who is already sufficiently familiar with the theories of photometry and illumination, or the student of illuminating engineering who is unfamiliar with higher mathematics, the book cannot be recommended. The subject matter has practically all been treated by other writers, and the book can hardly claim any other distinction than the author's particular method of presenting the various fundamental facts in the pure theory of the subject.

THE CALCULATION OF VOLTAGES FOR SPECIAL ARRANGEMENTS OF INCANDESCENT LAMPS, by Roscoe Scott; *Electrical World,* January 27.

The article deals with the problem encountered in changing over a system of carbon lamp illumination in street cars to tantalum lamps.

TUNGSTEN STREET ARCHES AT HOBART, OKLA., by G. E. Miles; *Electrical World,* January 27.

The arches described are interesting arches placed at five different street crossings. The construction is peculiar in that the arches are sprung from the pavement instead of resting upon poles or buildings.

AN ECONOMICAL ARRANGEMENT FOR STORE LIGHTING; *Electrical World,* January 27.

Treats of the use of the flaming arc for store and show window illumination.

QUEENSBORO BRIDGE ILLUMINATION; *Electrical World,* February 3.

A lengthy description with many illustrations dealing with the entire electrical problem of lighting this longest of the New York bridges.

STREET LIGHTING FIXTURES—INCANDESCENT LAMPS, by Gilbert Mulock; *Electrical Review and Western Electrician,* February 5.

A short article showing good and bad installations of decorative street lighting.

LIGHTING OF MARKET STREET, PHILADELPHIA; *Electrical Review and Western Electrician,* February 12.

A short illustrated article on this installation, of which so much has been heard during the past year.

THE METROPOLITAN TOWER CLOCK IN NEW YORK CITY, by Joseph B. Baker; *Electrical Review and Western Electrician,* February 19.

An illustrated and detailed description of the clock and the method of its illumination.

INDIRECT ILLUMINATION, by Augustus D. Curtis; *Southern Electrician*, February.

An illustrated article describing the number of noteworthy installations of the indirect lighting system with tungsten lamps.

INVESTIGATION OF METHODS OF CAR LIGHTING, by Edward Wray; *Railway Electrical Engineer*, February.

A continuation of the serial article, as noted in our last issue.

THE ILLUMINATED CLOCK, by "R."; *American Gas Light Journal*, February 7.

Describes several methods of illuminating clock dials, both by reflected and transmitted light.

LIGHT AND COLOR, by A. J. Marshall and F. L. Godinez; *Light*, January.

This is chapter ten of the series of articles on "Light and Illumination."

THE LIGHTING OF THE GAS EXPOSITION OF 1909, by A. J. Marshall and F. L. Godinez; *Light*, February.

An illustrated and descriptive article dealing with the illumination of the Madison Square Garden during the recent Gas Exposition.

EVOLUTION OF THE COLOR SENSE; *Optical Journal*, February.

An interesting article giving the results of observations and experiments in support of the evolution theory.

LIGHT TRANSMISSION, by E. A. Newing; *Optical Journal*, January.

A popular treatment of the subject of refraction.

RELATION OF PHOTOGRAPHY TO VISION. By Dr. F. W. Edridge-Green. Read before the Royal Photographic Society of Great Britain; reprinted in the *Optical Journal*, January 27.

An exceedingly well written article in which the similarity of the eye to the camera is carried out in detail. The treatment of the article is suggested in the opening sentence: "The eye has often been likened to a camera, but it is really a complete photographic apparatus."

COLOR VISION. By D. W. Edridge-Green. Read before the British Optical Society; reprinted in the *Optical Journal*, February 3.

Treats the subject scientifically but with exceptional clearness and simplicity of statement.

Foreign Items

COMPILED BY J. S. DOW

ILLUMINATION. EDITORIAL.

"GLARE" (*J. G. L.*, Jan. 18; *G. W.*, Jan. 15).

This relates to the last meeting of the Illuminating Engineering Society in London, when the subject of "Glare, Its Causes and Effects," was discussed, the proceedings being opened by Dr. J. Herbert Parsons, F. R. C. S. On this occasion the discussion was confined to the more physiological aspects of the subject. The meeting is commented upon in a number of journals in this country besides that mentioned above.

LA COSTITUZIONE DELLA "ILLUMINATING ENGINEERING SOCIETY," LONDRA (*Il Gaz*, December, 1909).

This is an interesting example of the keenness with which the proceedings of the Illuminating Engineering Society are followed in foreign lands. In this case the editor of *Il Gaz*, in Venice, publishes a very full account of the constitution and by-laws of the society.

DIE GUNSTIGSTE HOHE VON STRASSENLAMPEN, by J. Sumec (*Elek. u. Masch.*, Jan. 2).

The author discusses the different sys-

tems of testing the illumination in streets. He prefers the method of measuring in a horizontal plane, which should be as near the pavement as possible. He also advocates a method of recording results based on the product of the mean illumination and the minimum illumination between two lamps. Finally, he emphasizes the desirability of placing powerful lamps *high up*.

SHOP LIGHTING AND THE PUBLIC SAFETY (*J. G. L.*, Jan. 11).

This is one of many comments on the accidents that have recently occurred in several large electrically illuminated shops in London. It appears that the trouble arose through the crowding of incandescent lamps into the windows near inflammable goods. It is, therefore, recommended that such lamps should never be placed among the goods they are intended to illuminate, both on account of the risk of fire as well as from the illuminating engineering standpoint.

REFRACTORY MATERIALS IN LIGHTING AND HEATING, by O. Vogel (*G. W.*, Jan. 22; summary).

PHOTOMETRY.

A RADIOMETRIC PHOTOMETER, by H. Chapman (*J. G. L.*, Dec. 28, 1909).

Describes a patent on a type of photometer based on the use of a device of the same kind as the radiometer (*i. e.*, with blackened vanes, which rotate under the influence of radiant energy). It is only meant for the comparison of sources having the same spectral composition.

UBER GLUHLAMPENPRUFER, by B. Monasch.

The author discusses the class of instruments, measuring only the watts or current taken by a glow lamp, which are intended to be used to compare the efficiencies of different types of lamps. Such "photometers," as they are incorrectly termed, depend on the assumption that the metallic filament lamp tested gives the candlepower actually marked on the bulb. Dr. Monasch contends that such instruments are hopelessly inaccurate for the comparison of lamps of different types of the metallic filament variety, though they may sometimes be justifiably used merely to demonstrate roughly the difference in the performances of carbon and metallic filaments.

UBER DEN PHYSIOLOGISCHEN PROPORTIONALITATSFACTOR NEBST ANGABE EINER NEUER SUBJECTIVER PHOTOMETRIERMETHODE, by R. Stigler (*J. f. G.*, Jan. 15).

This is merely a short abstract of the paper. The author's contention seems to be that the present system of photometry is physiologically open to objection on account of the fact that the appearance of the illuminated surfaces depends on the part of the retina on which the image of them is received. He advocates binocular vision and has a new system of photometry, which, however, is not described in this abstract, the only point suggested being that it is of a complicated nature.

NOCHMALS DIE INTERNATIONALE KERZE (*J. f. G.*, Jan. 15, 1910).

One more contribution to the discussions in German papers on the international unit of light. The article deals with a letter from the Director of the Bureau of Standards, in which it is pointed out that the actual custodian of the unit of light is a series of standardized glow lamps, and that the unit could be preserved with sufficient exactitude by this means, since the error in photometric determinations should not exceed 0.1 to 0.2 per cent. However, the editor still finds fault with the use of the term "international."

THE DETERMINATION OF MEAN SPHERICAL CANDLEPOWER (*Illum. Eng.*, London, January, 1910).

The writer summarizes the chief methods of determining mean spherical candlepower and describes briefly several graphical simplifications in the calculations involved, and several forms of integration photometers of the Matthews and Krüss type.

ILLUMINATION, ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter; continued (*Illum. Eng.*, London, January, 1910).

The author refers to the effects of direct reflection or "glare" from the il-

luminated surfaces of photometers and explains how this error can be reduced below 1 or 2 per cent. He also draws attention to the fact that the result is in some measure dependent upon the direction from which the observer looks at the surface and analyzes the most favorable positions. Finally he gives the result of researches on different kinds of reflecting surfaces.

ELECTRIC LIGHTING.

Research on Metallic Filament Lamps, by F. H. Lavender (*Elec. Rev.*, Dec. 31, 1909).

The author describes a series of life-tests, etc.

Etudes recents sur les lampes a filament metallique, by C. Cheneveau (*La Revue Electrique*, Jan. 15).

Determination of the Temperature of Incandescent Lamps, by L. Crouch (*Elec. Rev.*, Jan. 7, 14).

Both these authors discuss the reason for the higher efficiency of the metallic filament lamps, which is mainly attributed to temperature. The two observers refer to the fact that it is very difficult to measure these high temperatures by methods which do not assume the "black body law." Nevertheless they attempt to derive relations connecting the volts, watts and temperature for different filaments.

The Manufacture of Metallic Filaments (*Elec. Engineering*, Jan. 6).

Refers to the claim of the B. T. H. Co. to have the master patent on the drawing of filaments from ductile tungsten alloys.

Die Herstellung der Metallfaden (*Z. f. B.*, Jan. 20).

Fortschritte in dem Bau von Bogenlampen, by W. Wedding (*E. T. Z.*, Jan. 13).

The Foster Multiple Carbon Flame Arc Lamps (*Elec. Engineering*, Jan. 6).

A New Flame Arc (*Elec. Magazine*, January).

Neuer Total Reflector fur Flammenbogenlampen, by K. Hrabowski (*E. T. Z.*, Jan. 6).

Describes a form of reflector for flame arc lamps which is partly prismatic and partly metallic. Its object is to modify the curve of light distribution so as to be more suitable for street lighting, and at the same time to reduce the effect of glare.

The Use of the Mercury Vapor Lamp for Sterilizing Liquids (*Rev. Electrique*, Nov. 30, 1909).

Electrical Effects at Drury Lane Theatre (*Elec. Engineering*, Jan. 13).

Electric Lighting for a Small Consumers (*Electrician*, Jan. 21; *Elec. Engineering*, Jan. 20).

GAS, OIL AND ACETYLENE LIGHTING, ETC.

EDITORIALS.

A Retrospect (*J. G. L.*, Dec. 28).

The Secret of the Mantle (*G. W.*, Dec. 25).

Incandescent Gas Lighting, by Fletcher (*G. W.*, Jan. 15; *J. G. L.*, Jan. 11).

The author describes the action of a number of burners. He expresses the view that no very beneficial result is attained by heating the gas and air before they are burned in the inverted mantle. He is also inclined to suppose that when an incandescent gas lamp gives evidence of a rapid diminution of candlepower this is due mainly to deterioration in the action of the burner, owing to want of attention rather than to the failing of the mantle. Nevertheless, cheap mantles sometimes fall off in candlepower very rapidly because they shrink in the flame.

The Early Development of Gas Lighting at the Beginning of the Last Century (*Illum. Eng.*, London, January, 1910).

Sketches the early development of the Gas, Light & Coke Co., and refers to some of the early prejudices the company

had to overcome. An interesting statement is made as to the illuminating power of the "Parish" oil lamps used before gas came in to illuminate public thoroughfares. The primitive open gas flame first introduced only yielded a light equivalent to three candles. Yet one such flame was equivalent to eighteen of the old oil lamps! When we observe, too, that these oil lamps were spaced at thirty to forty feet apart we can see how feeble the illumination on the streets at that time must have been.

THE HISTORY OF THE TALLOW CHANDLERS (*Illum. Eng.*, London, January, 1910).

The author sketches the history of the tallow chandlers just as he previously traced the development of the makers of wax candles. In both cases we find that rigorous regulations for the purity and perfection of the goods supplied were specified . . . something in the nature of a "standard specification" in fact, . . . but afterward the introduction of the newer illuminants was obstructed by the Guild of Tallow Chandlers, just as the wax chandlers had previously sought to suppress the manufacture of tallow candles.

EIN MIKRO-GASGLUHLICHT BRENNER (*Z. f. B.*, Jan. 10).

Refers to a very small form of burner said to have the smallest consumption of any existing type. The lamp is stated to give 16 candles and to consume 19 litres per hour (0.67 cubic feet).

OIL AS A LIGHTHOUSE ILLUMINANT (*Illum. Eng.*, London, January, 1910).

Describes the use of oil for incandescent gas lighting in the Kitson burner in lighthouses. Reference is made to the need for a good penetrating power in the case of lighthouse illuminants, and this, it is suggested, the incandescent mantle fed with oil has been found to possess.

ACETYLENE LIGHTS IN MINES (*Illum. Eng.*, London, January, 1910).

Describes a number of types of acetylene lamps for the illumination of collieries, and summarizes the qualifications such lamps should possess.

ACETYLEN IM KONKURRENZKAMPFE MIT GASBELEUCHTUNG, by R. Brusch (*Z. f. B.*, Jan. 20).

AIR GAS LIGHTING, by H. Carter (*J. G. L.*, Dec. 28, 1909).

THE ACETYLENE THEORY OF LUMINOSITY, by Prof. V. Lewes (*Acetylene*, January; *G. W.*, Jan. 8).

A PROPOS DE L'ECLAIRAGES DES PETITS VILLES, by L. Marmier (*Rev. des Eclairages*).

STRASSBURG GAS WORKS AND SUPPLY (*J. G. L.*, Jan. 18).

THE RAPID LIGHT CONTROLLER (*G. W.*, Dec. 25).

RELEVES STATISTIQUES DES RENSEIGNEMENTS RECUEILLIS SUR VINGT MILLE INATALLATIONS D'ACETYLENE (*Rev. des Eclairages*, Dec. 30, 1909).

Contractions used:
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World.
Illum. Eng. Illuminating Engineer (London).
J. G. L. Journal of Gaslighting.
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
Z. f. B. Zeitschrift für Beleuchtungswesen.

PROMPT HOLOPHANE SERVICE

The Holophane Company to-day gives as good service as any glass house in the world—and better than most. Since our General Offices were moved to Newark delays in executing orders have been completely overcome. With adequate stocks of all the more popular styles of Holophane Glass in Newark, New York, Boston, Chicago and San Francisco, there are now practically no delays in deliveries of anything but Steel Reflectors or such Glass Globes and Reflectors as must be made special. And with every member of the Holophane organization anxious not only to meet but to anticipate the trade's requirements, we have attained and will maintain an efficiency that guarantees prompt and satisfying service.

HOLOPHANE COMPANY

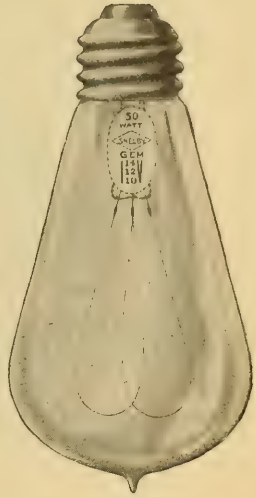
Sales Department

NEWARK, OHIO

New York Chicago San Francisco Boston

SHELBY LAMPS

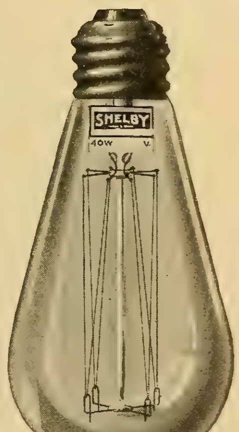
SHELBY
Useful Light Lamp



SHELBY
Gem

STAND
FOR
THAT
WHICH
IS
BEST

SHELBY
Tantalum



SHELBY
Mazda

Shelby Electric Co.

Shelby, Ohio

Offices or Agencies in all large cities

A LITTLE TALK TO YOU!

What are you earning as an illuminating engineer? It isn't enough, is it? Why are you not earning more? Isn't it because the field, especially the electrical field, is overfilled with ambitious young men as well educated and equipped as you are? Isn't this field overcrowded? It is. A whole generation of splendid young men have rushed into electrical illumination, leaving the other fields comparatively deserted.

Your knowledge, your ability, your training are needed in these other fields. The acetylene field is comparatively new. This wonderful means of illumination has and will continue to spread enormously. Problems are to be worked out which you can solve. Men engaged in this field are making twice and three times as much as you are. The acetylene field will not become overcrowded for years. It is your opportunity. Is it not worth investigating?

If enough has not been said above to set you thinking and induce you to write to the address below for information, the acetylene field does not need you. You are not awake. If you are made of the right stuff and with your technical training you are earning less than $2000.00 a year, you are wasting your talents in your present employment. Learn something of acetylene and its possibilities for you.

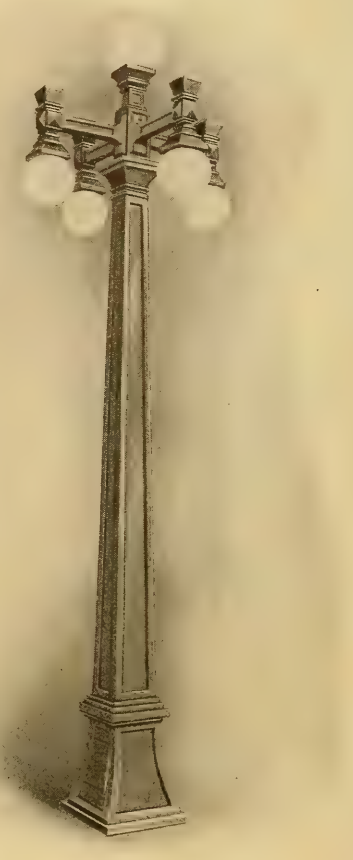
All Communications Confidential

A. CRESSY MORRISON, *Secretary*

INTERNATIONAL ACETYLENE ASSOCIATION

One Hundred and Fifty-seven Michigan Avenue, CHICAGO, ILL.

ONE
OF OUR MANY
DESIGNS



Design No. 40000

POSTS

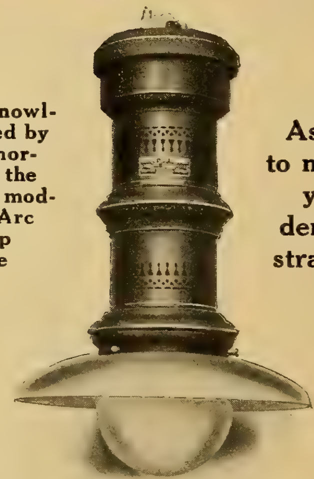
BRACKETS
AND
STANDARDS
FOR

Street Lighting

Elmer P. Morris Co.
1214—90 West St.
New York

THE
"Daylight" Lamp

Acknowledged by Authorities the best modern Arc Lamp made



Ask us to make you a demonstration

TYPE No. 3

Write for Particulars

Volkmer Electrical Company
585-589 Hudson St., New York

We Have
The Best of Everything in
Lighting Fixtures

Tell us your wants and we will tell you how to supply them.

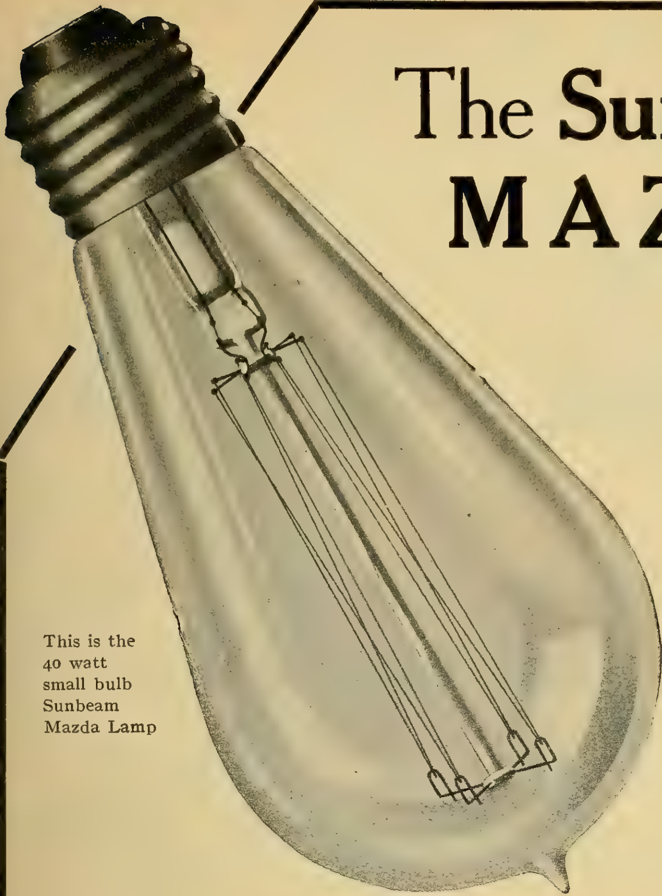
C. G. EVERSON & CO.
116 E. Lake St. :: :: Chicago

The tendency to-day

is toward refinement of taste and breadth of knowledge. The people are becoming more discriminating in their treatment of illumination, both public and private.

Nevertheless, there are still innumerable installations that are reminiscent of the old days of ignorance and indifference; that show almost "criminal negligence" in their disregard for the safety of the eyes,—that are as wasteful as they are dangerous, and as ugly in appearance as they are wasteful.

To the bettering of such conditions THE ILLUMINATING ENGINEER is concentrating its efforts, to the end that consumers may be brought to a realization of the profit they can secure, both in money and comfort, by the use of modern means and methods; and that manufacturers on their part may receive due credit and publicity for their enterprise in providing the ways and means for better things.



This is the 40 watt small bulb Sunbeam Mazda Lamp

The Sunbeam MAZDA

(WITH IMPROVED **TUNGSTEN** FILAMENT)

Burns Satisfactorily in Any Position

¶ At any angle — pendant — horizontal or upright. The 25 watt and small bulb 40 watt styles will fit any shade or fixture suitable for 16 c. p. carbon filament lamps. Equal life on either a. c. or d. c. circuits. Saves 66 per cent. in current consumption. Made in 25, 40, 60, 100, 150 and 250 watts. Prompt shipments from stock. Bulletin 6 F tells all about them.

— WRITE FOR IT —

Sunbeam Incandescent Lamp Company

Established 1889

Members of the National Electric Lamp Association

MANUFACTURERS

Chicago **Toronto** **New York**

Western-Electric

COMPANY

General Distributors

Stocks in 20 large Cities

WRITE OUR NEAREST HOUSE

Insist Upon Buckeyes

MANY people who buy their lamps of jobbers realize the superiority of Buckeyes, but because the jobber happens to handle some other lamp they allow themselves to be influenced by the just-as-good argument. Of course, there are other good lamps—but that is not the point. The point is that you ask for one thing and get another. The substitute lamps may possibly be as good, but the chance is about sixteen to one that they aren't. If you accept the substitutes you are taking a long chance unnecessarily. If your jobber does not handle Buckeyes, send your order to us direct. Our stocks are well distributed so that you will get prompt shipment. And whether you buy a case or a carload, your business will have the same scrupulous attention which all Buckeye customers enjoy. Wire the nearest office.

—THE—

BUCKEYE ELECTRIC COMPANY

MAIN OFFICE AND WORKS:

CLEVELAND, OHIO

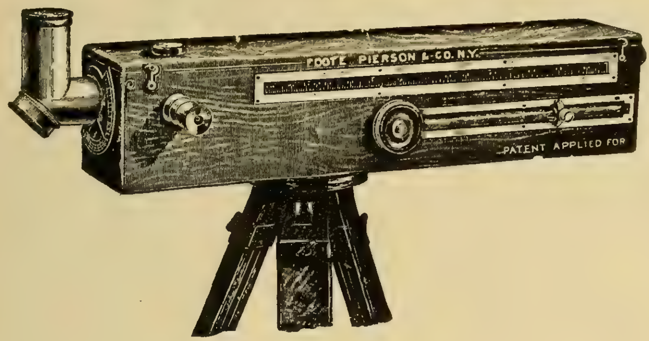
CHICAGO: 23 East Lake Street

PITTSBURG: Fulton Building

DALLAS: 220-221 Linz Building

DON'T "GUESS AGAIN"—

MEASURE IT WITH



A SHARP-MILLAR PORTABLE UNIVERSAL PHOTOMETER

The days of "rule-of-thumb" in lighting have gone by. Illumination is now an exact science, demanding instruments of precision.

The Sharp-Millar Photometer measures both light and illumination, either on the street or in the laboratory.

It is universally accepted as the standard instrument for the measurement of light and illumination and requires but little practice to obtain practically perfect results.

It is invaluable to lighting companies, illuminating engineers, and manufacturers of lighting apparatus.

Whether you want candle-power or foot-candles, the readings can be taken with exactness and certainty in any location or position.

Range from .04 to 400 foot-candles intensity of illumination.

Sensibility average, one per cent.

Every Photometer standardized by the Electrical Testing Laboratories and a Certificate of Standardization furnished with every instrument.

Write for Bulletin

FOOTE, PIERSON & CO.

Sole Manufacturers and Licensees

160-162 DUANE STREET NEW YORK

MAZDA

MAZDA

MAZDA

Highest Quality

Prompt Shipments

Packard Lamps

"Ask The Man Who Uses Them"

CARBON

TANTALUM

GEM

NEW YORK & OHIO COMPANY

WARREN, OHIO

Agents in all the principal cities.

The
Illuminating Engineer

Vol. V APRIL, 1910 No. 2

WHILE THERE'S LIGHT, THERE'S HOPE

According to Dante, the legend inscribed over the door of the Inferno is: "He who enters here leaves all hope behind." In all his gruesome and horrible conceptions of the tortures of the damned, the poet hit upon nothing more truly infernal than that expressed in this legend. The nations of antiquity had a vague notion of a place of future punishment which they called Erebus, a region of utter darkness, which lay between Earth and Hades. To be cast into utter darkness and deprived of all hope, what greater misery could be imagined?

Who has not at some time longed for the darkness of night to be dispelled by the light of the morning sun? "The cares that infest the night" "quietly steal away" at the dawn, or at the entrance of light, even more promptly than when "the night is filled with music."

There are few troubles short of acute dyspepsia that can withstand the cheerful and hope-inspiring light of the noon-day sun.

What a mistake it is to be niggardly with this source of mental and physical energy! The employer who allows even the suspicion of darkness to pervade the workrooms of his employees is cutting down their efficiency at a rate out of all proportion to the saving, leaving out of account any humanitarian sentiments. As well might he shut the doors of the furnaces which supply the power.

It is bad enough that a human being must be shut away from the natural light of heaven: to needlessly deny him the hope and inspiration of the best possible substitute is a wanton aggravation of this loss. We may not all work in the open, in the broad light of day, but we may all have such illumination from the many light-sources which science has provided as will produce a state of mind equally hopeful and cheerful.

Let there be MORE Light.

E. L. Elliott.

Public Lighting in Billings, Mont.

FIG. 1.—SHOWROOM OF THE BILLINGS & EASTERN MONTANA WATER POWER CO.

The average Easterner if asked what he knew about Billings, Mont., would most likely reply that he had not the pleasure of the gentleman's acquaintance. There are not a few indeed who would be puzzled to tell just where the State of Montana is located, except that it is somewhere out in the Rocky Mountains. Whether Mr. Billings himself exists in the flesh there is no question that the city bearing his name is very much alive, and can give pointers to most Eastern towns of its size as to the value of civic pride and push.

Billings has learned that electric signs and brilliant street illumination are the best possible means of giving to the city the appearance of thrift, business activity and public spirit, and is making such a liberal use of light as to entirely outshine most Eastern cities of its class. It must be admitted that the West does things quickly. A Western town will plan an extensive civic improvement, raise the funds by private subscription, or vote them from the public treasury, carry the plan into execution and forget the efforts and money expended while an Eastern town is debating whether or not it will spend 39 cents for a new cuspidor for the police station.

Eighteen months ago there was scarcely an electric sign in the city of Billings; today there are over 50 large electric signs with letters formed of lamps and a number of transparencies and illuminated sign boards. We have in mind an Eastern city of practically the same size, which has an ancient and honorable name, and in which there are but three small electric signs timidly displayed on side streets, two of these being theater signs. The 50 electric signs in Billings, of course, do not grow on the buildings like moss and lichens; they are as much an indication of the aggressive business policy of the local lighting com-

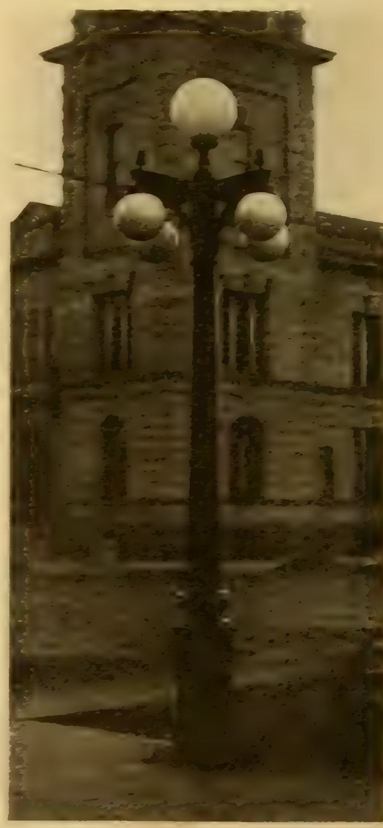


FIG. 2.—STANDARD TYPE ORNAMENTAL LAMP STANDARD IN USE AT BILLINGS, MONT.

FIG. 3.—DAY VIEW OF NORTH TWENTY-EIGHTH STREET, BILLINGS, MONT.

FIG. 4.—CHAMBER OF COMMERCE, BILLINGS, MONT.

FIG. 5.—NORTH TWENTY-EIGHTH STREET, LOOKING NORTH FROM MONTANA AVENUE.

FIG. 6.—NORTH TWENTY-EIGHTH STREET, LOOKING SOUTH FROM MONTANA AVENUE.

FIG. 7.—ANOTHER VIEW OF NORTH TWENTY-EIGHTH STREET.

pany as they are of the merchants by whom they are used.

A further proof of such progressive business methods is shown by the display room of the company, illustrated in Fig. 1. As will be seen, this room is brilliantly illuminated with the latest forms of lamps and accessories, while heating and other electric devices are displayed in the window. Incidentally, the lighting company of Billings has 1000 electric irons in service, besides washing machines and other electric household devices.

To make another odious comparison, the office of the local lighting company in the Eastern city mentioned is on a side street, and is never invaded by the customer except on the occasion of paying a bill.

Besides its private lighting in the way of electric signs and store windows, Billings has already a fine installation of decorative street lighting, tungsten lamps being used on handsome posts, shown in Fig. 2. The central upright lamp has a 60-watt tungsten with a 16-in. globe, while those on the arms are 40-watt tungsten in 12-in. globes. All five lamps are burned all night, the charge for which is $60 a year per post, the lighting company maintaining the globes and lamps. The lampposts are of a neat and substantial design, as shown. The several night photographs will give a fair idea of the appearance of brilliancy and life which pervades the business section of the city by reason of its free use of light.

The alertness of the local lighting company, whose corporate title is the Billings & Eastern Montana Power Company, is evidently only one phase of the general progressiveness of this thriving city. It has a Chamber of Commerce, which occupies a special building, shown in Fig. 4. The advantages of decorative lighting are utilized here as well as in the streets. While this building is not a colossal structure nor an architectural monument, it is decidedly well suited to its purpose of showing the visitor to Billings its various claims as a desirable town in which to locate a business or a home; and how many Eastern cities of the same size can show anything to equal it?

That such evidences of public spirit are not without their practical effect is shown

by an incident connected with the particular Eastern town to which reference has been made, one of whose leading merchants recently sold out and moved to Billings, where he is now conducting a prosperous business in his accustomed line.

The lighting company in Billings has recently been setting forth the most attractive features of private and public lighting in a series of full-page illustrated articles in the Sunday edition of the local paper. Billings claims to be the best-lighted city of its size in the Northwest, and from all evidences obtainable at this distance by photographs and descriptions this title seems to be very well founded. Surely our Eastern friends who have an inclination to follow Greeley's advice to "go West and grow up with the country" must find an atmosphere particularly congenial to growth in a city which shows such unmistakable signs of modern civic progress and prosperity. The East can learn many a lesson from the West.

The Relationship of Decoration to the Illuminating Engineering Practice*

By C. R. Clifford.

In considering the subject which you have intrusted to me we must concede at the outstart that the relationship existing between engineer and decorator is more theoretical than practical. The illuminating engineer has been always too busy with the installation of electric plants, the illumination of mills, big department stores, institutions and public buildings to give to the study of decoration any adequate consideration.

And as a result the illumination of the home is undertaken in a perfunctory spirit by somebody—or other—under the architect or decorator, who fixes his outlets according to order, a mere mechanic on the job. Such a man naturally occupies a negative position. He bears the same relations to what I conceive to be the illuminating engineer that the alleyway upholsterer bears to the professional decorator.

Gentlemen, there is a vast undeveloped field of usefulness in the illumination of the modern home, and neither the architect nor the decorator is competent to conceive its possibilities.

Whatever is good in decoration springs from the consistent relationship of color and form under certain light conditions. The decorator appreciates the charm of these conditions, which, for want of a better name, he calls atmosphere, and I know of no one more competent with proper study to create this atmosphere than the illuminating engineer. As the choice of color is guided by the conditions of light, the character of light is obviously of the utmost importance, and yet the subject is but vaguely comprehended. The technical man has given his life to economic rather than to psychological consideration. He has knowledge of power and energy, but he smiles indulgently and with smug complacency at the mere idea of estheticism. And yet the field is broad and profitable, and it would be a great relief to the decorator to be able to give over to you the illumination responsibilities in all that the term implies.

If you are not already recognized as factors it is because you have not awakened to your great powers. And what constitutes artistic illumination? Art is simply the expression of one's belief in the beautiful. It is a nice problem to decorate in a way to give true balance, for there is always the danger of overdoing. No matter how great one's admiration for a thing, there is always a final point of satiety where the desire needs rest.

A woman may love flowers, but in the season of flowers, when all nature supplies an overabundance and the visual sense becomes saturated and satiated, the home that is furnished in cool neutral tones is a

* A paper read before the New York Section of the Illuminating Engineering Society, March 17, 1910.

grateful and restful retreat, a relief to the eye overburdened with color.

So with light.

In 99 cases out of 100 the decorator furnishes the house and selects his colors by daylight; and in order that he may preserve the purity of the colorings by night, he is predisposed to the use of artificial white light—a continuance of daylight effects.

RESTFULNESS OF WARM-TONED LIGHT.

And yet nature provides restfulness, which comes with sundown. Why not follow the work of nature and into the home at night carry the quiet and peace of eventide, to rest one from the glare of perpetual day. If you are to impart the comfort-giving, pleasure-giving qualities which impel admiration you must grasp the subject from the decorator's standpoint and give him help. Above all else you must have imagination, the motive power of all enterprise, the impetus, the thought behind the act. In great feats of engineering imagination is one powerful fulcrum that lifts the spirit of genius to success.

The joys of the home, its ceremonial functions, its dinners and dances, even the quiet of an evening with the reading lamp, may be all enhanced or marred by your knowledge. It is not a matter of mathematics that is brought to you, it is a subject to which you must apply imagination that evokes the esthetic sense.

Instead of height and width, length and breadth, consider occasionally the light necessary according to the individuality of the room.

Consider the effects of refraction, the value of cove lighting by diffusion, the usefulness of the ceiling as a reflecting agent.

Consider the candle-power of a room only after calculating the probable color treatment of the room. It is an elemental principle, for example, in house decoration to select warm colorings for the north room on the theory that in the north room we have a natural cold light, and warm colors are preferable in the decorations. The electrician can therefore assume by deduction that he needs a greater amount of illumination in this north room, the room better lighted by nature, because the warm color tones used in the decoration of this room are factors which absorb light.

Consider the reduction of illumination by the addition of shadow casting furniture and light absorbing upholsterings and curtains.

Consider the usefulness of low lights for the dining room, the practicability of bookcase lights and closet lights and high lights at the bureau reflecting the image, and the blaze of light in the dressing room.

Consider the character of the drawing room and reception room, to which all ages and conditions of humanity have access.

Consider, independent of color, that dull and lusterless walls and velvet stuffs absorb light, while, independent of color, highly finished fabrics or woodwork reflect light.

Consider the loss of illumination by refraction and never lose sight of the fact that while it is necessary to have sufficient light where needed, there is a danger equally serious in overlighting and destroying the pictorial beauty of a room.

Consider the features of interest, the articles of special beauty and use your lights to accentuate their charms.

Consider that without shadow we have poor perspective. The illuminating engineer who throws light into the remotest corners destroys variety and pictorial character.

DANGER OF OVERLIGHTING.

The danger to good decoration is not only in overdecorating but in overlighting. The most effective room is the room illuminated with various degrees of strength.

We want shadows; we want light and shade. It is all right for the factory and showroom to have a penetrating white light that reveals every thread of the texture and preserves the integrity of every color. It is all right for the hospital and the operating table, but for universal home use, no.

And before you have given much study to your subject you will realize the crushing disadvantages of impractical and insufficient outlets.

Give plenty of outlets to a room. It will add to the selling value of the house. Thousands and hundreds of thousands of

dwellings are built each year on the country byways and city avenues evidently to be sold to some one who has nothing to do with their construction, and in all such buildings we find not only a heedless regard for light but a contempt for practicability.

Fortunately we are able to meet the utilitarian problem by stringing wires to movable lamps, but why employ the makeshift which is so obvious an attempt to correct the errors of the engineer.

Consider always the character of the room and its uses. There are times when it is pleasanter that the truth should be half told and the soft refulgent glow is better than the glare that is merciless.

The home is the theater of life. Then give us the lights that make joy and peace or happiness or repose.

LESSONS IN LIGHTING TO BE LEARNED FROM THE THEATRE.

Go to the mimic stage and observe the great work that is done there. No longer does the orchestra give the key to the emotion. We are not aroused to an extra heart beat by the shiver-music of the strings. It is the man with the light, and why? Because the play is always seen by artificial light, and whether the light simulates nature by daylight or moonlight the colorings on the stage are so selected that they are beautiful under the lights used and are not a discordant element, a sacrifice to the demonstrations of illumination.

Remember always that our social functions are at night, and even in the afternoon affairs miladi lights the candles and draws the shades, and the lights should be an effective aid to the colorings and not an influence emasculating and discordant.

All of this is known to the decorator. He perceives daily the possibilities of lights, but he knows not how to obtain them, nor does he know the man who is qualified to help him. It would seem, therefore, as though the illuminating engineer should qualify as the one authority not only upon all that pertains to the production and the installation of light but to its introduction through the medium of the chronologically accurate fixture.

The study of fixtures cannot be undertaken superficially. Immigration, commerce, the industrial arts, religion and politics have carried into the home for countless centuries what we have learned to regard as period furnishings and period styles, and to understand the periods you much comprehend not only the historical relations, politics and commerce of nations but the progress of civilization, art and industry.

You must follow the Renaissance developments through the Louis XIV, XV, XVI and Empire régimes. You must follow the inroads of the Dutch and her Flemish predecessors, the developments of the English from Henry VIII down to George III.

From the Egyptian to the Art Nouveau there is a span of thirty centuries, and to furnish the fixtures in the Elizabethan, Jacobean, Colonial, Oriental, Queen Anne and the innumerable other styles means study.

PSYCHOLOGY OF LIGHT.

And what of the mystery of your lights? Did you ever stop to think of the psychology of light? Chromotherapy is the science based on the effect of colored lights on the human body. For years Schopenhauer, as well as Herbert Spencer, searched for an explanation of the effects of music on the emotions, and yet the effect of color upon the nerves of nervous people is more distinctly shown than the effects of music.

The Dutch savant Van Bliervliet holds that the senses directly affected by color furnish absolute nourishment to the intellectual factors, and experiments made simultaneously upon a dozen people chosen haphazard showed that the most intelligent were those most easily affected by color or music.

Physicians have discovered that nervous prostration may be successfully relieved by color, especially violets, blues and greens. Reds are exciting, orange and yellow stimulating.

It is well to consider that there should not only be no glare in the study to disturb one but that a blue, green or violet light should be used. We look for the gaiety of orange and yellow and red in the drawing room. Hence the popularity

of the yellow of candlelight diffusing joy. It is the sunshine of night.

Nature provides vast fields of green because favorable in its effect upon animals.

Experiments show that men of extreme sensibilities exposed to red light show excitement, giving increased muscular development. I commend you to a study of the work of the illuminating engineer employed upon the stage of the play "The Harvest Moon." If there is doubt in your mind of the psychological influence of light and of its great interest to the public, I commend you to watch this audience spellbound in its interest.

Vavin, the scientist, when seen with Holcomb and Dora, the lovers of the play, before leaving them in the moonlight, leads up to the situation by presenting his views on color lighting, and here is an abstract:

Vavin: Do you know the effect of color on the audience?

Holcomb: Color?

Vavin: You have heard of Nancy, in France—the town?

Holcomb: Yes.

Vavin: And Dr. Charcot?

Holcomb: Yes.

Vavin: He was my friend. We made together many experiments of the effect of color upon many persons under hypnotic influence. Invariably under yellow the subject laughs; under green he is content; under red he is stimulated; if it is brown he is in fear; if violet he weeps; under blue there is a—what you call it manner?—distrait?

Dora: Perplexed?

Vivin: Perplexed.

Holcomb: Don't you think, Monsieur, so much attention to the light is a bit theatrical?

Vavin: Theatrical?

Holcomb: Not true to life.

Vavin: Life? Do you know, Monsieur, that 60 per cent. of the causes of falling in love are in the moonlight in life? Do you know the harvest moon?

Holcomb: You mean the full moon that comes at harvest time?

Vavin: (Nodding). Do you know its peculiarity? Generally the full moon rises nearly an hour later each night.

Holcomb: Well?

Vavin: The harvest moon, at the full, comes up three nights almost at the same time. Did you think of that, and why do you suppose?

Holcomb: Why?

Vavin: That harvesters, men and women, shall fall in love with each other. Oh, it is a droll God, Monsieur, that plays that trick for one hour on His children. Think of it, Monsieur—a harvest moon for one hour! Is that of the theater? No—it is a droll God. Now I cannot show you—I have no arrangement to get the blue light, which is mystery; and the green light, which is content, and which together make a moonlight—when two people come together, mystified and happy, and say, Ah, this is fate, we are for each other since the beginning.

It is not the white line alone that is wanted, it is not the purity of color value that we must consider in lighting, it is first the object of the room and then the practicability of the outlets; then the influence as expressed by the volume or the color of your light.

Take a lesson from the influence of light on this audience and Vavin and consider if the influences of your work may not extend beyond the purely mechanical.

Railroad Illuminating Engineering

By Harold Kirschberg.

With the natural growth of the scope of human endeavor, a necessity for specialization in the field of knowledge becomes more strongly apparent as these lines of endeavor become more widely diversified. This is perhaps truer when considered in relation to our great railroad systems than with most of the other corporate interests resulting from our modern economic conditions. A railroad, catering as it does to the public at large and to so many different interests in general, finds it necessary to have at its command the systematized knowledge of all of the modern professions. It is certainly true that as any field of science develops to the point where special consideration of its application demands attention, that field may be found in its most salient features, if not in its entirety, in the scope of general railroading. The foregoing will hold true as well for medicine as for law and as well for agriculture as for engineering.

The particular field with which we are principally concerned, that of illuminating engineering, is as yet, so young that very few, including the railroads themselves, are awake to the very urgent need of a specialist in this line to assist in successful and economic railroading. It is the purpose of the author to open to view in this article a glimpse of the possibilities of illuminating engineering in its relation to a railroad.

Illuminating engineering on a railroad may be divided into its various branches, at least for the purpose of reference, as follows:

Commercial lighting,
Industrial lighting,
Esthetic lighting.

Under the heading of commercial lighting may be included all lighting used for the continuance, after daylight becomes insufficient, of business of any sort not directly or intimately connected with any process of manufacture or physical handling of manufactured material. Such lighting may be said to include the following cases: General clerical offices, hallways and corridors, etc., station waiting rooms, concourses, platforms and shelters, ticket offices, cars, reading rooms, hospitals and operating rooms, drafting rooms, stores, boats, train sheds and the multitude of similar public places maintained by a railroad. This covers practically all of the field of this branch of illuminating engineering, so that it can be truly said that the demands of a railroad cover all of the field of commercial lighting.

The second heading, industrial lighting, includes lighting of all locations where material or equipment used or transported on the road is manufactured, handled or stored for future use, or where power is generated for moving equipment and maintaining efficient train movement and is divisible into lighting of the following places: This enumeration is as complete a compilation of this branch of illuminating engineering as it is possible to cover: Shops, yards, piers, power plants, freight stations, transfer platforms, track scales and humps, turntables, roundhouses, baggage rooms, stock rooms, tunnels. Because of the great number of special cases of lighting included in the foregoing and the number of extraordinary conditions to be satisfied in the solution of many of the problems, it is manifestly impossible in an article of this length to go into the details of any one case. The author hopes, however, in the near future, to present some of the most interesting problems, an example of which may be cited as that of track scale lighting.

The third heading includes a field of more or less indefinite limits and may be said to include a variety of lighting for either useful or ornamental purposes or for both. As examples, the following may be cited: Residences, private offices, club and meeting rooms, restaurants, cafés, private cars and all cases where light is used for artistic effect in addition to producing illumination.

With the exception, therefore, of theatres and churches, it is evident that the entire field of general illuminating engineering is to be found within the limits of railroading. To offset the lack of the few illuminating problems which are not presented by the necessities of a railroad are those many instances which not only are very special, but are not to be found anywhere else. The considerations which enter into any problem in illumination are very often accentuated on a railroad, as is the case, for instance, in the reduction of brilliancy or shielding of lamps used to illuminate a runway crossing tracks at terminals. In such cases glare is not only discomfort, but is positive danger. It is evident that a number of the subdivisions enumerated in the foregoing paragraphs are not only special cases, but in some instances are fields of endeavor sufficiently large in themselves to command all the time and attention of an expert.

The field offers a place for every illuminant of merit on the market, and poor indeed is any lamp which will not suit some particular set of railroad requirements. The railroad illuminating engineer, however, bears a distinctly different relation to his employer than does either the consulting or otherwise employed illuminating engineer. He is not bound to use the output of any manufacturing concern to the exclusion of other devices of merit on the market, as is the engineer employed by a corporation manufacturing lighting apparatus. His critics, however, consist of the public at large and the world well knows what a problem it is to please the multitude. In addition he is required to make his suggestions as much of a commercial bid as would be required of any contractor. Railroads are far-sighted corporations, and the installation which will not stand the test of years both operatively and financially will stand no more chance of acceptance than would a lead dollar in the U. S. Treasury.

A railroad is both a purchaser and a generator of energy, a goodly percentage of which is used in the production of light. The railroad illuminating engineer, therefore, does not stop his investigations with the lighting layout. He is required in addition to consider either all phases of the generation of the energy he desires to use or the factors which enter into the economical purchase of same from a central station.

The foregoing exposition, however, only touches upon some of the phases of the work. An additional scope of work is presented in which light and color in all of their diversified phases of range, purity, saturation, contrast, etc., are the factors of importance. The signal field undoubtedly requires the services of an expert in light, and it is to be expected and desired that he who handles illumination problems will also control all the problems in which light is involved. At the present time railroads throughout the country are considering the advisability of changing signal colors and their significance as such due to peculiarities of light not taken into account at some previous time when the present code of color signals was devised. That the services of one learned in the science and application of light and color would be of great value in the solution of this problem is a self-evident fact. The manufacturers of glass to meet the requirements in this regard are at present giving this matter a great amount of attention, and it is meet that the railroads should have men of the particular knowledge and ability to assist them in the development of what is really a new application of knowledge. How often have lives been lost due to mistaking the color of a signal, an error perhaps not due so much to inability on the part of an engineman to distinguish same as to variation of color absorption with dry or moisture laden atmosphere or distance effect tending to absorb a greater amount of the shorter than the longer wave lengths from the light passing through the lantern globe or roundel.

The possibilities of manufacture in the production of comparatively pure colored glass, the chemistry of same and the production and efficient use of the flame back of the glass are all problems the solution of which is up to the railroad illuminating engineer. Much progress in the production of light from various forms of energy has been recorded in the past twenty-five years, but a comparatively small amount of that progress has been in the field of railroad signaling by means of

light. In some cases where legislation has attempted to force such progress the results have been quite contrary to those expected, as witness, for instance, the effect of locomotive arc headlights, made compulsory a comparatively short time ago in some States, on a red signal lantern. Here is another case wherein the services of a light expert would result in not only a better, but undoubtedly a safer, method of realizing the desired result.

Besides the foregoing instances wherein the application of illuminating engineering principles is productive of beneficial results, there is still a great number of problems where the introduction of light as a factor will assist to a great extent toward a better solution and a more reliable operation. Without doubt an investigation and redesign of most of the lighting installations at present in use on our railroads will in themselves so far reduce energy and maintenance costs as to justify the railroad illuminating engineer in setting aside for the present all consideration of novel uses of light on his system. From the power installation viewpoint itself, where the plants furnishing the energy belong to the railroad, a reduction in energy consumption and a consequent increase in plant and transmission line ability to furnish a greater number of places is often productive of a twofold saving by obviating both the necessities of buying energy from an outside concern and installing additional generating apparatus for an already overloaded plant.

Considered altogether, it is already high time that the railroads awakened to the fact that they present to the illuminating engineer for economical supervision a wider scope of work than does any other line of endeavor, that illuminating engineering is able to save them many thousands of dollars per year, and that for successful operation an illuminating engineer is as necessary to the railroad as is a forester, a signal engineer or a superintendent of telephone and telegraph.

Show Window Lighting

By A. D. Curtis.

There is more proportional waste in the illumination of show windows than in any other department of a store. If the same rate of loss occurred in the other departments it would mean quick bankruptcy to thousands of merchants. Cases where there is a 30 to 50 per cent. loss are very common, and in many instances there is more than this.

As the item of show window lighting runs from a nominal sum up to $5000 per year in the case of some of the largest stores, it is easy to realize that the waste in show window lighting in the aggregate is enormous.

This condition of affairs is not entirely the merchant's fault. Until recently he has had no scientific engineering information by which to be guided. The usual plan has been the " hit or miss " one of installing any kind of a reflector the merchant or the electrician thought " would do." Often the merchant has installed some particular reflector after having seen some other show window where radically different conditions prevailed, apparently well illuminated with the same reflector. It is the purpose of this paper to show how and where this loss occurs and how it can be stopped.

The losses in window lighting are chiefly due to:

1. Inefficiency of the reflecting surfaces of the reflectors used;

2. Poor design and improper shape of reflectors;

3. The use of reflectors ill suited to the purpose.

Illuminating engineering of show windows has recently made great advances. Instead of wasting from 30 to 50 per cent. of light (a) on the ceiling, (b) on the ends of the window, (c) in the extreme top of the back of the window, and (d) on the sidewalk, the light can now be concentrated on the goods where needed by using reflectors of correct design, thereby not only eliminating loss, but

FIG. I.—TYPICAL LIGHT DISTRIBUTION MIRROR TROUGH REFLECTOR WITH 100 WATT TUNGSTEN LAMP.

greatly improving the appearance of the goods displayed.

The tungsten lamp, as is well known, gives about three times the light for a given amount of current that is given by the old carbon filament lamp; and when used with reflectors of scientific design will illuminate the show window to the best advantage, from both the standpoints of effect and economy. In these days of constantly increasing operating expense in the conduct of business it will be interesting for the merchant to realize that in this department at least better results can be obtained, with a saving in operating cost.

SOME FUNDAMENTAL PRINCIPLES OF WINDOW LIGHTING.

In the show window no light should be exposed so as to be in the ordinary range of vision. The show window being primarily to attract the purchasers' attention to the goods displayed, rather than to the light, nothing should distract from this purpose. In this connection the merchant can well learn a lesson from the theatrical stage manager.

Brilliant exposed lamps are used on or near the stage only when it is desired to blind the audience temporarily, so that change of scene or the devices for performing tricks of magic on the stage cannot be seen. In the performance of some feats of magic this temporary blinding of the audience by means of brilliant light is very cleverly effected by a row of powerful lamps with reflectors around the borders of the stage. In this way the audience is prevented from seeing certain devices which might otherwise be detected. But note that exposed lamps are *never* used when it is desired that you should have the best view of the stage.

A good way to blind a prospective customer so he cannot see the goods on display in the window is to put exposed lamps around the window borders, or suspend them from chandeliers, or so install them in the top of the window that his eye cannot escape them.

The light must come from in front of the goods in order to avoid shadows. If the lamps are placed in the middle of the show window ceiling the front of goods displayed in the front of the window will be in darkness because of the shadows. Strange to say, many do not consider this. If the display is altogether on the bottom of the window, as in the case of a jewelry store, this shadow effect is unimportant. In the clothing or dry goods store window it is vital.

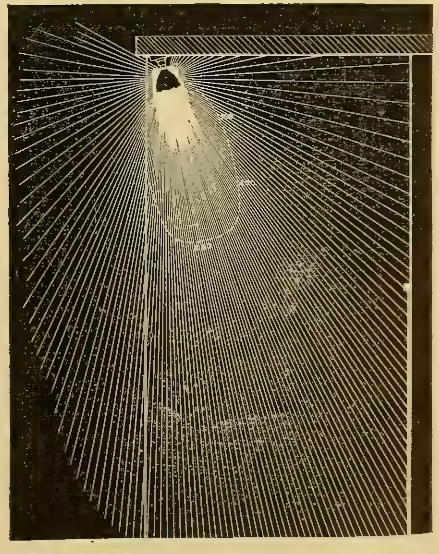


FIG. 2.—TYPICAL LIGHT DISTRIBUTION OF TRANSLUCENT FOCUSING TYPE REFLECTOR WITH 100 WATT TUNGSTEN LAMP.

Carrying out this principle, that light must be thrown on the goods from the front of the window in order that passers-by may see no shadows on the goods, practically means that the lamps must be placed high up in the window next to the window pane, because there is no other place where they can be put to throw the light in the proper direction and keep the lamps out of the ordinary range of vision.

Common sense and the common practice of the largest and best managed concerns having established the proper place for show window lamps as the front and top of the window, what are the essential conditions for efficiency? Any one can flood a show window with light by sticking enough lamps along the transom bar, but that does not mean that the lighting is done efficiently. Perhaps the same results—that is, the same illumination on the goods—could be accomplished with half the number of lamps, or half the current. To use the light generated by lamps efficiently, so that the merchant gets his money's worth in illumination, is not a matter of hit-or-miss guesswork, but requires good illuminating engineering.

First of all, the lamps must be equipped with reflectors that will direct *all* the light generated into the windows instead of allowing it to escape into the street and over the top and ends of the window.

For example, in Fig. 1 is shown a cross section of a window seven ft. deep, which is to be trimmed to a maximum height of 7 ft. at the back. The lamps are 13 ft. above the floor of the window, near the ceiling. The window in Fig. 1 is equipped with a trough reflector, now frequently used with tungsten lamps. This trough is effective in lighting windows only because of the large number of lamps which can be placed per front foot of window; in other words, the results are obtained at an extravagant cost for electricity. The reason for this is that a large per cent. of the light is not directed into the show window at all, but into the street and over the tops and ends of the window. Too much lighting of the sidewalk detracts from the lighting effect. The darker the sidewalk the brighter the window will appear to be lighted. While it is not desirable to have the sidewalk in darkness, there need be no fear of this, because the reflection from the goods and back of the window will light it sufficiently for all practical purposes without allowing any light to fall there directly from the lamps and reflectors.

Fig. 2 shows a window of the same dimensions as Fig. 1, also equipped in an inefficient manner. In this case translucent reflectors are used. These reflectors allow considerable light to pass through the reflector, which is an excellent characteristic for some kinds of lighting, but is not at all adapted to a show window, where it is desired to concentrate all of the light possible on the goods below.

With the focussing prismatic or opal reflector used with a 100-watt tungsten lamp the maximum downward candle-power obtainable is less than 300, as indicated in Fig. 2. (The illumination in Fig. 2 was plotted from the published curve of the translucent reflector, usually used for this purpose.) This result, as compared with the results that can be obtained, as shown later, is due to the fact that so much light is allowed to escape through the reflector and in other directions than on the goods displayed.

Fig. 3 shows a window of the same

FIG. 3.—TYPICAL LIGHT DISTRIBUTION FROM SILVER PLATED OPAQUE REFLECTOR WITH 100 WATT TUNGSTEN LAMP.

dimensions as Figs. 1 and 2, but equipped with a reflector which was especially designed for lighting windows of this class.

The distribution of light from this reflector, as shown by tests, is substantially as indicated, and it will be seen that nearly all of the light is delivered on the goods displayed. Furthermore, because of the efficiency of the reflecting surface used, and because of the correct size and design of the reflector for this particular work, over 800 maximum downward candle-power is obtained, as against less than 300 with translucent reflectors using the same size lamps as in Fig. 2.

Of course, if the window has different dimensions from those shown in Figs. 1, 2 and 3, and the lamps are placed lower, a different reflector would be required; and for such purposes other reflectors have been designed. It is important to use the right reflector for the window. It is not enough to simply prevent the light from ever falling outside of the window space; the reflector must have an efficient reflecting surface, so as to efficiently direct into the window the light which would otherwise escape in other directions, and must also be accurately designed to so distribute the light within the window as to illuminate all the goods displayed at about the same intensity.

As before stated, the reflector must have a reflecting surface that will be permanent and efficient; that is, it must not only have the highest possible initial efficiency, but not tarnish or blacken under the action of time and the heat of the lamps. Bright metal, such as tin or aluminum, and white enameled paint or opal surfaces have also been used for reflectors, but cannot compare in efficiency with pure silver plating, and, furthermore, white surfaces give a diffuse reflection, and therefore cannot concentrate the rays in a particular direction.

LAMPS PER FRONT FOOT.

The number of lamps per front foot of window, or the watts per front foot required for good window illumination, depend very much on the location of the show window, whether it is on a brilliantly lighted street and in a city where a great deal of light is commonly used in show windows, or whether it is in a town where only a limited amount of show window lighting is common. For example, in a small country town a single reflector may give a better illumination of a window with an 8-ft. frontage than is common among the other windows in the town. In large cities, where dark dry-goods and men's clothing are displayed, some merchants consider that a window cannot be too brilliantly illuminated.

POINTERS ON WINDOW TRIMMING.

It is usually conceded that a show window has as great an advertising value by night as by day, and if well illuminated is much more prominent after night than by day. The trimming should be adapted to the artificial illumination. Nevertheless, we frequently see windows so arranged that it is impossible to properly light the goods displayed. Always remember the direction from which the light is coming. Do not arrange the goods so that they cast shadows on themselves or on other goods. Do not put high objects near the front. Do not attempt to put too many high things close together in any part.

The New Lighting in Central Park, New York

Whatever may be said in favor of light units of high power like the electric arc for the lighting of open streets, there is no question as to the great advantage of smaller units for the lighting of parks and avenues which are shaded by trees. In such cases it is absolutely essential that the light-sources be placed underneath the overhanging boughs in order to prevent shadows, which in the case of the old open arc lamp were as bad as material obstacles in the road. The series tungsten lamp certainly fills the traditional "long-felt want" for exterior lighting of this kind.

The value of light in rendering streets safe from personal attack is thoroughly well recognized. That the same is true in parks will probably be readily accept-

Copyrighted by the New York Edison Company.

FIG. I.—FOUNTAIN AND LAKE, SHOWING NIGHT ILLUMINATION.

ed; but the difficulty and expense of affording sufficient illumination to dispose of all lurking places for the criminally inclined has heretofore prevented to a large degree the securing of an equal amount of safety by this means. In the larger cities especially one of the most important uses of parks is as a place of resort where those who are weary with the toil and heat of the day may find both rest and the refreshment in the cooler air. But, while parks invite the laborer and the peaceful citizen to recreation, they likewise furnish an ideal haunt for the tramp and the footpad, unless very thoroughly lighted.

Time was when some of the lesser of New York City parks were unsafe for either man or woman to walk in at night, in spite of the protection of a really competent police force. Recent installations of tungsten lamps have changed these con-

Copyrighted by the New York Edison Company.

FIG. 2.—LIGHTING ALONG THE MALL, LOOKING NORTH.

Copyrighted by the New York Edison Company.

FIG. 3.—ANOTHER VIEW OF THE MALL.

ditions materially, if not dispensed with them altogether.

The lighting installations recently put up in Central Park are interesting, not only from the fact of their being in one of the best known parks in the world, but as showing the enormous improvement which is produced.

Fig. 1 shows the fountain and lake. This being a winter scene, the fountain is, of course, out of commission, but the illumination would render night skating not only possible, but highly enjoyable.

Fig. 2 shows the lighting along the "Mall," looking to the north.

Fig. 3 is another view of this favorite section, while Fig. 4 gives a daylight view showing the appearance of the lamps and posts.

Two types of lamp-posts are used: the

Copyrighted by the New York Edison Company.

FIG. 4.—DAYLIGHT VIEW OF MALL, SHOWING TYPES OF LAMP-POSTS.

one, of which two different variations are shown in Figs. 5 and 6, is an adaptation of the old "boulevard" gas-light fixture;

FIG. 5.

FIG. 6.

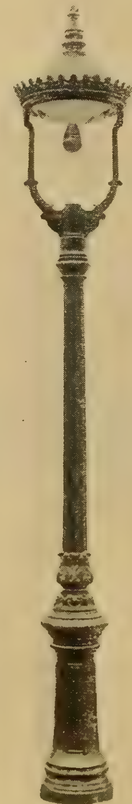


FIG. 7.

the other is a strictly electric post, with a lamp in an upright position in a frosted glass globe, as shown in Fig. 7. The posts are of cast iron, finished in verde bronze. The post shown last is exceptionally well proportioned, being neither so light as to look flimsy, nor so heavy as to be out of proportion to the globe which it supports.

Altogether the installation is most satisfactory, both in point of illuminating effect and artistic appearance.

The Living Electric Sign

By O. D. Ziegler.

Since the trick of producing effects of motion in electric signs was discovered there has been a constantly increasing use of this device. Some of the most elaborate signs of this kind at the present time are almost equivalent to an entire vaudeville act. In fact, many of the schemes used in the theatre to produce motion effects are utilized in electric signs; thus, to show a moving vehicle wheels are made to appear to revolve and the nearby objects to pass by. Both the direct light

FIG. I.

of lamps of various sizes and colors and surfaces showing by reflected light are utilized to make up the combination.

The advertising value of electric signs is undoubtedly of the very highest order; otherwise fortunes would not be put into them, as is being done to a greater and greater extent. A sign now being constructed along the "Great White Way" in New York stretches the entire depth of a prominent building, and the steel framework rises several stories in height. The cost of this framework alone would build a very comfortable suburban cottage, and the monthly rent for the site would certainly have to be expressed in four figures.

A few signs in which motion effects are the chief element of attraction are shown herewith. Fig. 1 is a sign erected at Euclid Beach, a lakeside resort of Cleveland. The "act" is as follows: The girl first appears on the platform, poised for a dive. She then disappears for a few seconds, and is next seen just as she enters the water, which splashes and ripples as she disappears. The following legend then appears in letters of light: "Come in, the water's fine." No human mind is free from the power of suggestion, and this catchy invitation undoubtedly attracts many a bather.

FIG. 2.

Fig. 2 is a pictorial representation of a joy ride. The dust is seen flying from the revolving wheels, the smoke from the men's cigars floats away and the ladies' veils flutter in the breeze. To put the finishing touch on the realism, even the warning, "Honk, honk," is given by means of an electric horn.

Advertising psychologists lay down the following action of the human mind as

FIG. 3.

the basis of their work: First, attention; second, interest; third, desire. Will any one question that all three of these motives to action are inspired by such a spectacle as this?

Fig. 3 goes through the following motions: First, a woman with uplifted arm and stick is "discovered"; second the words "Old Dutch Cleanser" appear; third, the words "Chases dirt"; fourth, the beating of the stick. This short, but realistic, act cannot fail to leave a memory of 'Old Dutch Cleanser" that will sooner or later come out in purchase.

It pays to advertise.

Elmer W. Gillmer

The electrical community was shocked when, on Saturday, February 19, the wires flashed across the country the news of the sudden death of Elmer W. Gillmer of Warren, Ohio, president of the National Electric Lamp Association and the founder of the Warren Electric & Specialty Company, the Colonial Electric Company, the Peerless Electric Company and the Hydro Electric & Gas Company of Warren, Ohio.

ELMER W. GILLMER.

The sudden passing out of the electrical world of a character so vigorous, a personality so strong, and apparently the picture of health and strength, is a blow the full measure of which is not yet realized by the electrical industry.

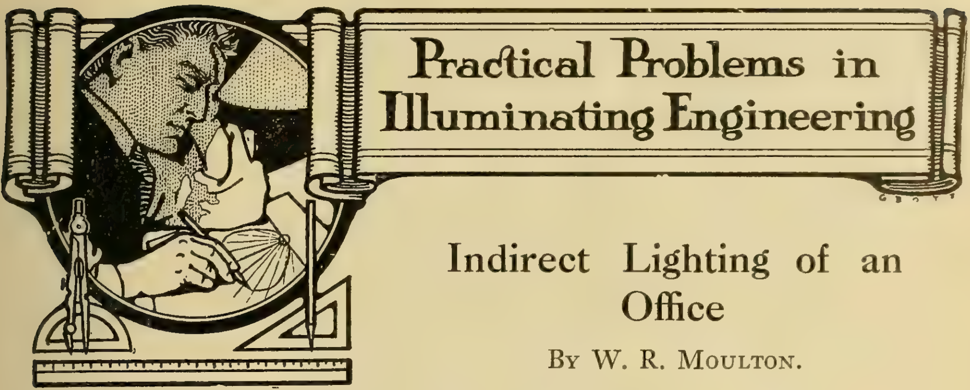
Elmer W. Gillmer was distinctly a product of the town with which he identified himself, having been born in Warren, March 28, 1862, and in the same city, in the retail business, up to 30 years of age, he prepared himself for the phenomenal success of his later years by learning men, in daily contact with them, in various clerical capacities in the retail business. In 1893, with characteristic foresight, he saw the opportunity for development on the west side of the city, and in developing that section he founded, in a modest way, a manufactory of incandescent lamps. The arrival of the man at his work was immediately demonstrated, and it was not long before Peerless lamps were known wherever electric lighting existed. This beginning of successes was followed by others equally noticeable and the name of "Gillmer" rapidly became a household name, especially with the large jobbing electrical interests.

In 1902 the lamp interests of the companies controlled by him became affiliated with the business of the National Electric Lamp Association and the Peerless Electric Company was incorporated.

Last July Mr. Gillmer succeeded the late Mr. J. C. Fish as president of the National Electric Lamp Association, and since his election to that high office has forwarded the interests of the association with the same ability, thoroughness and foresightedness that characterized his handling of his more personal interests.

His loss will be keenly felt by all those associated with him, either in a business or social way, but the foundation laid by him in his business associations will long continue to bear fruit to the best interests of the electrical community for many years to come.

Mr. Gillmer's funeral was held on Tuesday afternoon, February 22, the remains being placed in the mausoleum erected by him at the time of his second son's death a few years ago, in Oakwood Cemetery, Warren, the pallbearers being Messrs. W. C. Ward, E. E. Nash, J. B. Estabrook, David Estabrook, Robert Bean and George Daugherty. The honorary pallbearers were members of the National Electric Lamp Association and consisted of Messrs. F. S. Terry, B. G. Tremaine, T. Robert Crouse, W. H. Roberts, S. E. Doane and L. P. Sawyer.



Indirect Lighting of an Office

By W. R. Moulton.

During the past two years there has been a decided improvement in office conditions in this city. The employers are now wide awake to the fact that cheerfulness and satisfaction in surroundings are two of the most potent factors in increasing the efficiency of employees.

The first and the greatest step toward better conditions has been taken by improving the illumination, a typical example of which is here shown. This photograph shows a section of the extensive Chicago offices of the Standard Oil Company. In this department there are about

FIG. I.—ONE OF THE STANDARD OIL COMPANY OFFICES, CHICAGO, LIGHTED BY INDIRECT ILLUMINATION.

twenty-two employees, all doing work which requires very close application. The lighting originally consisted of twenty-six desk lamps and bracket lamps of 16 candle-power each and three four-arm chandeliers, with a 32 candle-power lamp in each arm. With this equipment fair illumination was obtained, but it was localized to the area under each lamp, the rest of the room appearing dark in comparison and a great amount of valuable space was occupied by the desk lamps. The total current consumption was about 2750 watts, carbon lamps being used throughout.

Indirect illumination was installed about the first of the year, and after six weeks of constant use has proven to be even more satisfactory than was originally anticipated. The illumination is clear and strong (about 3.8 ft. cd. on the desks). At the same time all glare from high power illuminants is entirely eliminated.

The accompanying illustration, which was taken by this light alone, expresses better than words the present cheerful condition of the offices.

With this equipment, 500 watts per fixture is used, making a total of 1500 watts for the room, and it is very evident that there is a great saving in current consumption, the exact amount of which cannot be determined, because the desk lamps may not all have been used at one time, but it approximates about 40 per cent.

This first installation proved so entirely satisfactory that the greater part of the Chicago offices of the Standard Oil Company have lately been equipped with this system of indirect illumination.

The Lighting of a Grocery Store

NORMAN MACBETH.

The up-to-date merchant appreciates the possibilities of more satisfactory illumination with increased intensities if he believes he can afford it, and other points being equal, will agree to pay an amount which very nearly remains constant regardless of the resultant illumination. The higher the efficiency of the light producer, the greater will be the illumination contracted for. Lower the efficiency or increase the cost and it will be found that just as soon as the merchant has a grasp of the situation he will either proceed to get the illumination he desires at the price he is willing to pay or the amount of his purchase will be reduced through a curtailment of the hours use or by the substitution of a new installation which promises to better meet his requirements.

This situation is very thoroughly brought out in the installation here shown and described.

Figs. 1 and 2 show the interior of the store of Sol Cahn & Co., Pensacola, Fla. In 1907 an installation of nine upright mantle gas arcs was replaced with twelve 187-watt Gem lamps, with prismatic reflectors.

The Gem lamps later gave way to 12 100-watt tungsten lamps, and in the fall of 1909 the tungsten lamps were taken out of commission and inverted gas lamps on standard fixtures having a central control cock in the fixture body and equipped with independent pilots and prismatic reflectors were installed.

The illumination from these four systems, calculated from the watts or cubic feet per square feet on the basis of two lumens per watt for the Gem, four lumens per watt for the tungsten; 55 lumens per cubic foot for the arcs, and 100 lumens per cubic foot for the inverted lamps, as here used, would probably average: Arcs, 5 foot-candles; Gem, 2.3 foot-candles; tungsten, 2.5 foot-candles; inverted gas lamps, 7.3 foot-candles.

The energy costs per 100 hours use (omitting maintenance and lamp cost), with gas at $1.50 per 1000 and electricity at 15 cents per kw. hour, would be: Gas arc, $27.00; Gem, $33.66; tungsten, $18.00; inverted lamps, $21.30.

The reduced illumination resulting when the Gem was installed and the gas arcs " taken down and carried away " was probably due to the strong " illuminating engineering sales arguments," which were

FIG. I.—GROCERY STORE, PENSACOLA, FLA. NIGHT VIEW, WITH GAS ILLUMINATION.

more of a novelty, as an aid to salesmanship, at that date than at present.

It is well known, although not generally appreciated, that 5 foot-candles on a horizontal plane with a somewhat higher intensity on the walls and ceiling, secured with the usual upright arc equipment, is in many instances not more satisfactory than 3 foot-candles on the horizontal plane and 1 foot-candles on the walls and ceiling. The more highly illuminated upper walls cause a stopping down of the pupil of the eye to such an extent that the effective illumination, that which enables us to see clearly, distinctly and with ease, is considerably reduced below what might be expected with 5 foot-candles under the more favorable conditions of less highly illuminated walls and ceiling. With Gem lamps on a free renewal basis and the average maintenance charge on arcs, the net costs of these two systems would not differ considerably.

The introduction of the tungsten lamps was evidently on the lines of " the same illumination at a reduced cost." The increase from 2.3 to 2.5 foot-candles, representing a lesser consideration than the reduction in energy, costs from $34 to $18 per 100 hours' use.

Up to this point an excellent example is afforded of the aid which the attention to scientific principles as applied to illumination can be turned to the advantage of the central station. The present installation is likewise an indorsement of the value of these same principles when applied by the gas man.

As the tungsten installation was undoubtedly representative of the best available from an aggressive central station management, so is the present the best that can be furnished by the up-to-date gas company. The general appearance of the two installations is quite similar, as is also the light distribution characteristics of the two lamps as equipped with prismatic reflectors. The gas man, however, ap-

proached the problem from a slightly different standpoint—the consideration of a handsome store in which a brilliant effect would be appreciated.

The store interior is one large show window, consequently four outlets, No. 1, No. 2, No. 3 and No. 4, Fig. 3, were provided on a line 4 ft. inside the plate glass front and doorway, each equipped with a four-light fixture. This resulted in an intensity on the show cases and goods displayed in the front of the store of over 12 foot-candles.

Nine other outlets, Nos. 5 to 13, were arranged symmetrically on the ceiling at approximately 14-ft. centers, with a spacing of 7 ft. to side walls, to uniformly illuminate the rest of the store. It may be noted that the old arc lamp outlets were not used, nor were the new outlets placed to correspond with the electric outlets, excepting at such points as would be satisfactory.

A usual method where competition is active has been to substitute lamp for lamp, using lamps of a size to afford a somewhat similar illumination, depending entirely upon the one point—reduction in costs—to warrant the change.

Had this been done in this instance the gas costs would have been approximately $7.20 per 100 hours' use. From the standpoint considered, however, of the best the market affords, the cost per 100 hours' use has been raised above the tungsten, from $18 to $21 per 100 hours' use—over 15 per cent.—with an increase in effective illumination of nearly 200 per cent., or if the intensity were equaled in tungsten the cost would be over $50 for similar hours use, or equal cost with electricity at about 6 cents per kw. hour.

The present method of control, each fixture with an independent pull chain, doubtless has an advantage over that previously in use, where to turn on one lamp necessitated using three or four lamps at the same time.

FIG. 2.—VIEW LOOKING ALONG THE FRONT OF THE STORE.

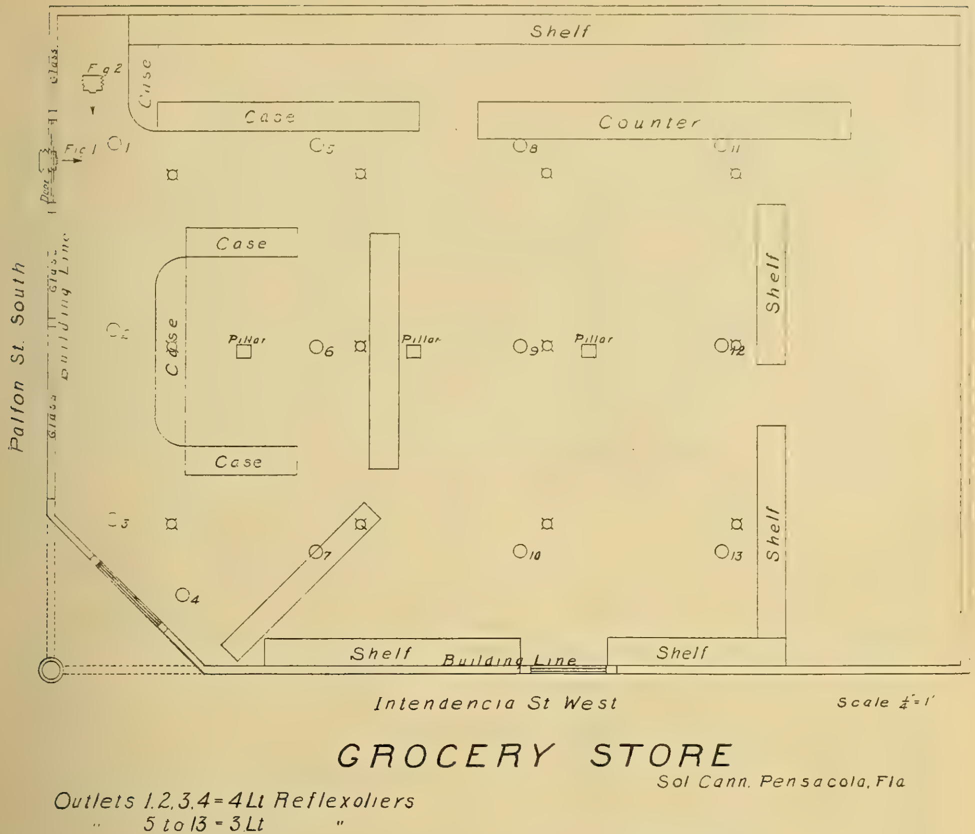


FIG. 3.—FLOOR PLAN, SHOWING GAS AND ELECTRIC OUTLETS.

SUMMARY OF INSTALLATION.

Dimensions of store	44 x 62 ft.
Total area in sq. ft.	2828
Effective area in sq. ft.	1940
(Clear in front of shelving.)	
Height of ceiling	14 ft.
Height to mantle centers	11 ft. 6 in.
Number of fixtures used	13
Number of lamps	43
Nominal consumption per cu. ft.	3.3
Total consumption per hr. cu. ft.	142
Cu. ft. per effective sq. ft.	.073
Area front section sq. ft.	425
Cu. ft. per sq. ft. front section	.124
Lumens per cu. ft.	100
(Factor with light ceiling, medium walls.)	
Water, gas.	

The calculation for a floor of the size above described is not necessarily deep nor difficult.

Taking the effective area, 1940 sq. ft., which is the total floor area to the fronts of the shelving, and multiplying same by the intensity in foot-candles desired, which may be assumed for this store as 6, gives (1940 x 6) = 11640. This amount, divided by the factor for the equipment shown, which is 100 lumens per cubic feet of gas per hour for light ceiling and medium walls, gives 116.4 cu. ft. of gas necessary. This amount, divided by the nominal consumption per lamp 3.3 cu. ft. per hour, gives the number of lamps required ($116.4 \div 3.3 = 35.3$), or 35 to 36 lamps. The spacing as shown by the plan, Fig. 3, was arranged in consideration of the distribution of light from the units to be used. The "distance between outlets should not exceed 1⅔ times the height of the lamps above the plane to be illuminated." The plane is considered at the height of the counters, 2 ft. 6 in. above the floor.

This consideration would result in placing 12 outlets, as shown on the plan No. 1 to No. 13 (omitting No. 4). With 12

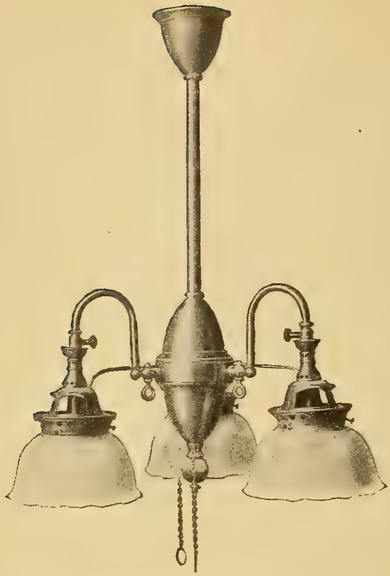


FIG. 4.—TYPE OF UNIT USED.

outlets and 36 lamps (36 ÷ 12), three lamps should be used per outlet. This arrangement would result in a uniform illumination throughout the entire room of 6 foot-candles intensity.

It was desired, however, because of the absence of a show window, to build up the intensity in the front of the store and at the main entrance; consequently a four-light fixture was added at outlet No. 4 and an additional lamp allowed on the three outlets, No. 1 to No. 3. The photographs, Figs. 1 and 2, were taken at night from the positions as marked on plan, Fig. 3, and show remarkably fine results.

It is encouraging to those interested in the general advancement of illuminating engineering to know that this and many similar creditable installations are being handled by the regular staff of the new business departments of the gas companies in various sections of the country.

Indirect Lighting of an Automobile Salesroom

By H. B. Wheeler.

The increasing demand for automobiles for use in all classes of work and pleasure has necessitated the building of numerous garages and show rooms to handle the ever increasing auto trade.

The Anderson Carriage Company to successfully care for their patrons have recently erected one of the finest buildings in the country for the exclusive use and display of the automobile. The garage has all the up-to-date conveniences necessary for charging and repairing batteries, automobile parts, etc. The display room is one of the most beautiful and splendidly appointed electric show rooms in the city. Everything throughout is finished in white enamel except the side wall panels, which are light yellow. All panels in the walls and ceiling are surrounded by a border on the brown tinge. The style of architecture is of the Italian Renaissance period. The architecture, decorations and interior furnishings are beautifully shown in the illustration, which was taken by the light of the new indirect illumination.

The proper illumination of show rooms for displaying automobiles, accessories, etc., has always been a difficult problem to handle by direct lighting methods. When chandeliers, with various types of glassware, were employed, the lamps (especially since tungsten lamps have come into such general use) have stood out very pronounced, thus detracting one's attention from the cars displayed. With direct illumination, heavy shadows were cast, and certain parts and sides of the cars displayed appeared dark, hiding many of their graceful lines and fine points.

To overcome as much as possible the difficulties of exposed units and glare (but not shadows), beam ceilings were specified in the newer buildings. Behind these beams lamps and reflectors of various designs were placed. From the street this gave the salesroom the appearance of a long show window, and the results were fairly satisfactory until one came within. In examining an automobile it was necessary a considerable part of the time to face the exposed lamps, intensified by reflectors back or around them. This was a great

FIG. I.—SALESROOM OF ANDERSON CARRIAGE COMPANY, CHICAGO, SHOWING EFFECT OF INDIRECT ILLUMINATION.

annoyance to the prospective buyer, and even more so to the salesman who was compelled to work under these conditions the greater part of the time. Thus we see that, although when viewed from the street the display room was fairly well illuminated, when inside conditions were about the same as when chandelier lighting, with exposed lamps, was employed.

Indirect lighting in this installation has entirely eliminated all of the above mentioned disagreeable features, such as exposed units, glare, shadows, high lights, etc., by spreading throughout the room a soft and even flood of light. No matter from what point the cars are viewed there always appears to be the same light. No shadows are cast and the highly polished surfaces are brought out on all parts of the cars with exactly the same intensity, which is impossible with direct illumination.

The engineering data and specifications for obtaining these results in illumination of this show room are as follows:

Main salesroom, size 44 x 55 ft.

Alcove, 10 x 10 ft.

Number of outlets in salesroom, eight.

Number of outlets in alcove, one.

Fixtures in salesroom, eight four-light, containing four 100-watt clear bulb tungsten lamps per fixture.

Fixture in alcove, one one-light, containing one 100-watt clear bulb tungsten lamp.

Watts per square foot in salesroom, 1.32.

Watts per square foot in alcove, 1.00.

Total watts, salesroom, 3200.

Total watts, alcove, 100.

Average foot-candles throughout salesroom and alcove approximately 3.5.

E-100 reflectors were used in the salesroom. E-100 is a diffusing type of reflector.

E-200 reflectors were used in the alcove. E-200 is a concentrating type of reflector.

All reflectors are a one-piece glass reflector, with spiral and vertical corrugations, plated with pure silver, giving the most efficient reflecting surface known to science.

Top of reflectors in both salesroom and alcove, 30 in. from the ceiling.

FIXTURES.

The fixtures are of the bowl type, as shown in the photograph, the bottom of each consisting of open work. All bowls are lined with a golden colored silk, which allows sufficient light to be diffused through the open work to give the fixture a soft glowing appearance, which eliminates the dead effect so common in many large fixtures. The fixtures are finished in Roman gold, which blends very nicely with the interior decorations. The reflectors are placed within the bowls on a level with the top of same, and are entirely hidden from view. It will also be seen from the photograph that no exposed lamps are in sight.

Indirect illumination has not only proven satisfactory in lighting this beautiful new salesroom, but in banks, libraries, residences, hotels, art galleries, theaters, and, in fact, any room or building where a soft and evenly diffused light, devoid of shadows and without glare, is desired, it has met with great success.

OFFICE IN THE NEW ADDITION TO THE WHITE HOUSE, IN WHICH INDIRECT LIGHTING WOULD CORRECT THE FAULT OF THE ORIGINAL INSTALLATION.

Studies of Notable Installations

Some Peculiar Cases

The question of how to properly light a billiard table has been frequently discussed in these pages, and there seems to be almost as many ways of solving the problem as there are of killing a cat. If the problem is admittedly difficult where electric light, the most adaptable of all light-sources, is available, what could be expected where neither gas nor electricity is to be had? How would you go to work to light a billiard table properly with kerosene lamps? This is the question that confronted the owner of a country home in Virginia. That the first

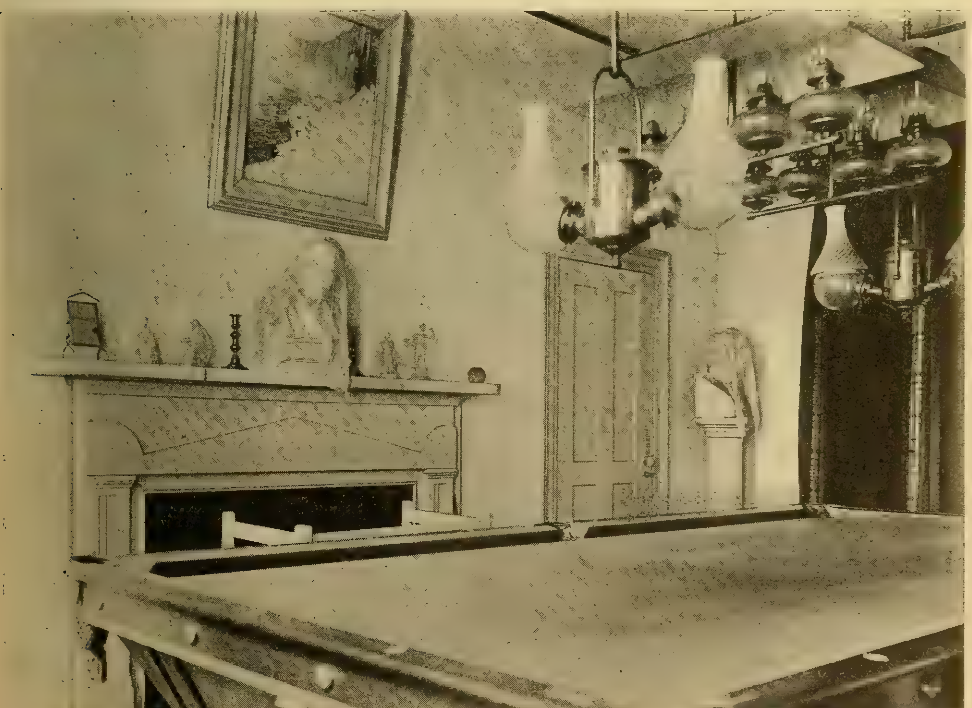


FIG. I.—A SOLUTION OF BILLIARD TABLE ILLUMINATION IN AN OLD VIRGINIA MANSION.

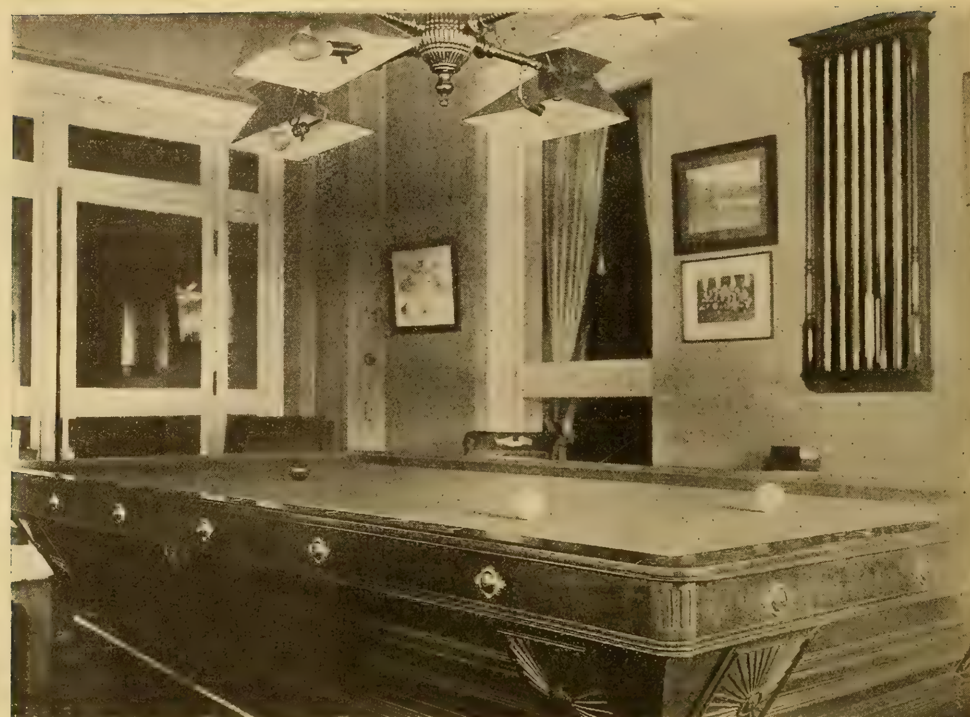


FIG. 2.—BILLIARD ROOM, GOVERNOR'S MANSION, AT ALBANY, N. Y.

solution of the problem was unsatisfactory is evident from the second attempt, which is shown in the illustration, Figure 1. In the first effort eight ordinary flat-flame lamps were used, arranged in two sets of four each, and supplied with a trough reflector. It seems as though this arrangement should have given fairly satisfactory results had the two fixtures been separated so as to hang over the table symmetrically. Two good central draught lamps with fairly large opal glass reflectors hung so as to light the table evenly should give a fairly satisfactory illumination. It is doubtful if this billiard room is much patronized in the hot summer evenings.

Governor Hughes of New York is a minister's son and his skill at this popular game is thus far not a matter of public record. Just the same, ample provision is made for the pastime in the executive mansion in Albany. Figure 2 is a view showing the billiard table and its method of lighting. The latter seems to be a make-shift contrivance to convert an old-

FIG. 3.—HALLWAY ILLUMINATION.

time gas fixture into an electrolier. By what perversity of genius the flimsy arrangement for holding the lamps in a horizontal position under the nearly useless reflectors was conceived is past finding out.

Figure 3 is a view of a hallway in a modern colonial country seat. How to adapt the electric light to the strictly colonial type of architecture is one of the many puzzling problems. The effort shown in this case can hardly be called successful. In the first place it is doubtful if our forefathers who were wealthy enough to build a mansion would have shown such poor taste as to hang up a lantern for interior lighting.

In the second place, even had a lantern been used, it certainly would not have been attached to the ceiling by a rigid tube or rod, but would have been suspended by a chain or flexible support. And lastly, there would surely not have been an electric lamp in it.

A view of the library in the Washington residence of the late John Hay is shown in Figure 4. The provision for lighting is most unusual. There is a light-source in each one of the numerous small panels of the ceiling, evidently provided with a reflector and screened by frosted glass. The single purpose in view is plainly to light the entire room like daylight, or even more uniformly, so that a person can sit at any place, facing in any direction, and read comfortably without the glare of any visible light-source to bother. There was evidently no thought of economy of electricity. The man who devised this installation knew what he was after and had the courage of his convictions.

FIG. 4.—LIBRARY IN RESIDENCE OF THE LATE JOHN HAY, WASHINGTON, D. C.

Fixtures and Accessories

The Mechanical Basis of Art in Fixture Design

Let us take up again the subject of the two general methods of construction, viz., the rigid and the elastic.

In Figure 9 an attempt is ostensibly made toward greater elasticity by giving the arms an entire semi-circular bend at

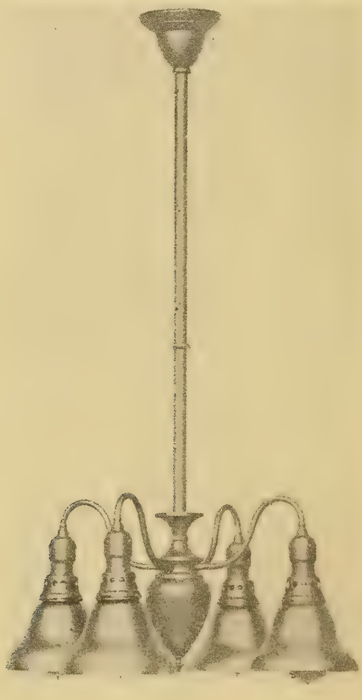


FIG. 9.

the outer extremity. This, however, only accomplishes the purpose of placing the lamp in a vertical position, without removing the inherent weakness shown in Figure 7; a sufficient weight at the end of the arm would break it off at its point of attachment. This mechanical and artistic weakness is successfully overcome by giving the arm either an upward or downward curve at the point of attachment, as shown in Figure 11.

Another effective means of overcoming this weakness is by the use of a brace which affords a line of support from a point above to some point in the arm, as shown in Figure 10. Undoubtedly this fixture would withstand all the strain required of it if these braces did not exist; it is not the actual mechanical weakness that needs correction so much as the *feeling* of weakness that the construction pro-

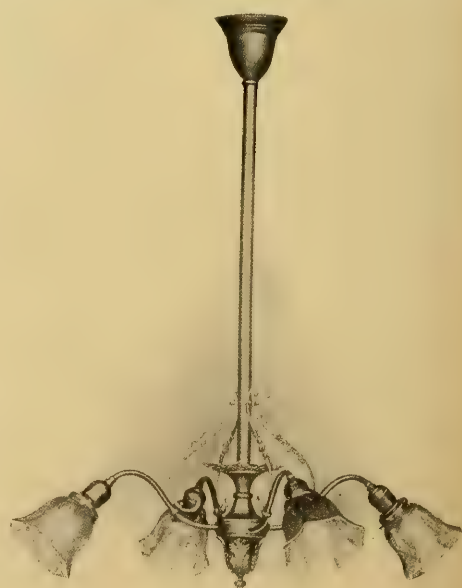


FIG. 10.

duces. The subconscious mind does not stop to analyze and argue, but judges by

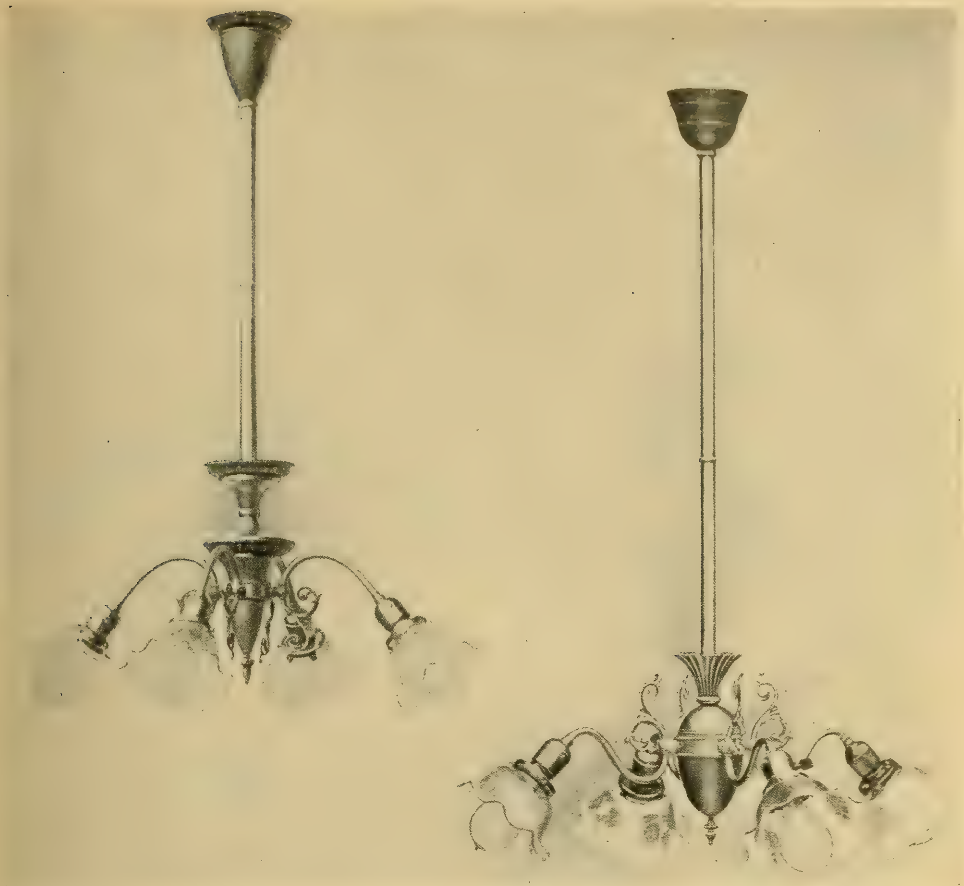


FIG. 11.

first impressions. The point to be observed is that the artistic feeling is plainly and unequivocally traceable to apparent weakness.

One of the most obvious transgressions against the law of mechanics, and strangely enough, one which is very common, is the use of a brace with one of its points of attachment omitted. This is on a par with the arch having the key-stone left out. Figure 12 is an example of this kind. The arm is mechanically weak owing to its straight horizontal form at the point of attachment. This weakness could be easily overcome by the use of the brace, and this is apparently what is intended by the metal scroll attached to the arm. This scroll, however, falls short of accomplishing its purpose by having no point of attachment above, and therefore becomes an additional useless weight, instead of forming part of the structure. Attach this brace, as shown in Figure 13, and at once this heretofore useless appendage becomes a necessity, with the result that the design at once satisfies the eye. Similar constructions can be found in abundance, especially in the older designs. At the present time rigidity is usually sought for, rather than elasticity.

Another error occasionally met with consists in giving such a formation to the arm that the outer end is the larger, as shown in Figure 14. The attempt here to represent the allegorical "horn of plenty" is by no means sufficient to overcome the inflexible law of mechanics, which demands that the strongest part of a projecting arm shall be nearest the support. The defect in this particular case might

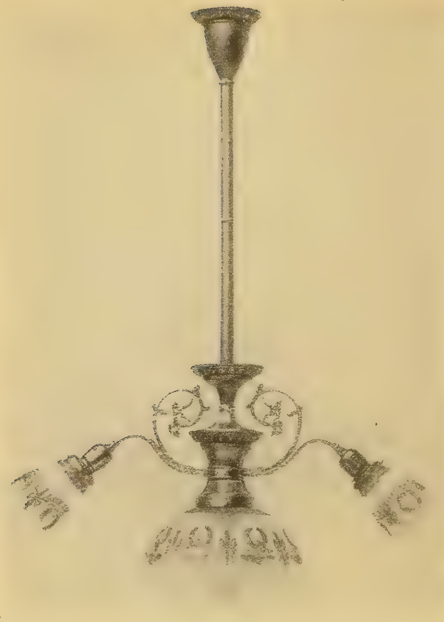


FIG. 12.

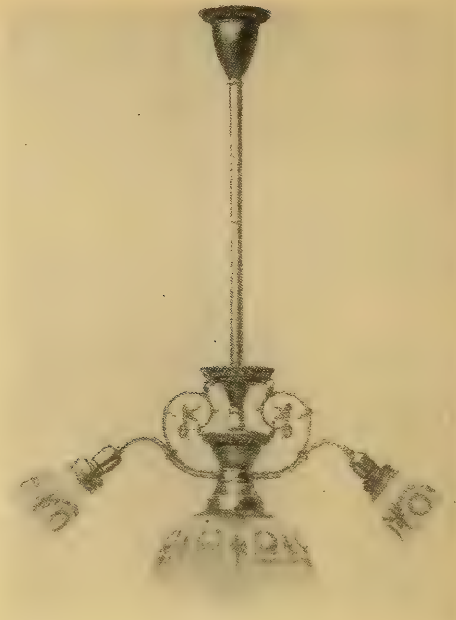


FIG. 13.

FIG. 14.

FIG. 15.

have been overcome by somewhat extending the curve at the supporting end and attaching it as a brace. That the argument is sound is shown at a glance by an inspection of Figure 15, in which the arm is considerably enlarged at the point of support.

The examples given should be sufficient to demonstrate the general proposition that it is impossible to produce a truly artistic effect in a lighting fixture while transgressing the laws of mechanics underlying its structure. The artist who would paint the human form effectively must know at least the fundamental facts of anatomy. No skill in the use of color, or talent in portraying facial expression can atone for manifest contradictions of the human structure; and this in principle is true in every branch of art.

Glass Lamps and Candlesticks

Of all the materials available for the construction and ornamentation of lighting apparatus none is more appropriate nor susceptible of more artistic effects than glass. It is its quality of transparency or translucency which gives to glass a charm that no opaque substance can possess under various conditions of light.

The metal lighting fixture, no matter how artistic the design or how excellent the workmanship, generally loses most of its beauty when the lights are in use. In fact, there is nothing which requires more careful lighting to bring out its beauty than art metal work, and these conditions are rarely met when the metal itself supports the lights, as in the case of lamps and fixtures.

Glass, on the other hand, shows the beauty of the material itself and the workmanship by both reflected and transmitted light. Whether you look *at* or *through* a piece of glass it possesses an inherent beauty.

France, in the period from Louis XIV to the Empire, undoubtedly developed as exquisite and admirable a system of decorative art as has ever been brought forth in any single period in history—a fact that is attested by the general use made of these motives among decorative artists at the present time. While the best light which was available at that time was the candle, so admirably were the chandeliers adapted to its use, and so beautifully were they decorated, that they have served as models until this day. The principal material used for decoration was crystal glass, cut into prismatic and jewel-like forms.

The art of pressing glass, which is a mechanical operation and of course much cheaper than hand cutting, has been brought to great perfection in America. Many of the pieces made by this process to-day are scarcely distinguishable from the far more expensive cut forms.

With the popularity of Colonial architecture there has come a demand for Colonial furniture. As the lamps actually used in Colonial days were imported, designs using glass decoration were common. The glass lamp and candlestick is, therefore, not only a thing of beauty in itself, but particularly suitable to Colonial furnishings. American glass makers have wisely taken their designs, as far as possible, from actual patterns used in Colonial times, and many of the candlesticks, candelabra and oil lamps are really fine pieces of the glass worker's art, while the mechanical method of their production renders their price exceedingly moderate.

With the exception of cut flowers, there is no table decoration which can equal the glass candlestick, holding a real candle, with or without a shade. Thanks to American mechanical ingenuity, such candlesticks can be had at a cost which puts them within the reach of the most modest cottager. The new lights are all good in their place; but though they give the brilliancy of the sun, they cannot extinguish the quiet beauty of the candle.

The Art of Illumination

Illumination was recognized as an art before it became known as a science, the first comprehensive treatise on the subject being entitled "The Art of Illumination." Engineering primarily implies the application of scientific principles to practical affairs. The art of illumination and the engineering of illumination therefore signified quite different processes. Since the establishment of illuminating engineering as a science and profession the question of the extent to which this science includes the art of illumination has never been settled. The word "art" used in this particular expression has both of its meanings —that is, it implies the special degree of skill and ingenuity which comes from study and experience and also the application of esthetics, which is concerned with conceptions of beauty.

Those who have essayed the rôle of illuminating engineer have occasionally found themselves between two fires; if they have ventured to discuss the artistic side of illumination or to criticise lighting installations along these lines, they have been warned off in no unmistakable language, and told to "stick to their knitting" of facts and figures. Engineering has nothing to do with esthetics; therefore the illuminating engineer has no license to deal with the subject of decoration or artistic effects in any way, shape or manner.

Now comes a professional decorator, standing very high in his profession, who takes the illuminating engineer to task for neglecting the artistic side of the problem, which he contends is often quite as important as the scientific side.

In a paper prepared for the Illuminating Engineering Society, and found in another section of this issue, Mr. Clifford makes an open appeal to illuminating engineers to take up the *art* of illumination, and so be in a position to give to architects and decorators much needed assistance in this highly important matter. There is undoubtedly a gap to be bridged between the architect or decorator who has been accustomed to consider lighting chiefly with regard to its effect upon the artistic *tout ensemble* of their work and the practical illuminating engineer who has been confined to the application of physical laws. This gap may be spanned in either one of two ways: the decorator or architect can study the scientific principles of illuminating engineering upon which both utility and art are based; or the illuminating engineer who wishes to either specialize in this direction or to fully round out his professional knowledge can study the subjects of decorative art and architecture so as to be fully competent to appreciate the motives of the decorator and architect, and to design schemes of illumination which will harmonize with and carry out their ideas.

The subject of illumination is both broad and deep, and is already developed to such an extent that one may be well satisfied with mastering some one particular phase of it. The architect lays the foundation for his professional work by the study of mathematics and physical science, and so must one who would become proficient in the art of illumination begin by acquiring a basic knowledge of the scientific principles of illuminating engineering. Upon this groundwork there is no reason why one who has an artistic

temperament should not make such a study of art as applied to architecture, especially the part which light and illumination have in this art, to make himself a most valuable adviser to the professional architect or decorator. Such an expert in the art of illumination would undoubtedly win recognition from the really broad-gauge members of the architectural profession. Let it be understood that illuminating engineering is the science and art of light, and that any member of the profession may specialize along either the scientific or the artistic side; but unless he specializes on the artistic side let him refrain from attempting to force his practical and mathematical notions upon those who are bound to consider the artistic side as well as the commercial.

A Standard of White Light

In a paper read before the New York Section of the Illuminating Engineering Society, Mr. D. McFarlan Moore again sets forth the claims of the carbon-dioxide tube as not only a substitute for daylight in determining color values but as a standard of white light. At the same meeting Dr. H. E. Ives presented a paper on the "Color of Artificial Lights" which was in the nature of a résumé and conclusion to his previous papers on the same subject.

Undoubtedly the most important conclusion from the numerous attempts to obtain the color composition of average daylight is, that there is practically no such thing as obtaining such an average, as Dr. Ives points out. Not only are the variations exceedingly wide, but the question as to the "weighting" of the different values, *i.e.*, the relative importance which should be given to daylight at different parts of the day, renders any mathematical attempt at attaining an average so largely a matter of opinion as to preclude any possibility of concordant results among different observers.

One of the most elaborate investigations of the problem was made by Professor Nichols, the results of which were embodied in a paper presented to the society two years ago. Yet as elaborate as were Dr. Nichols' experiments, Dr. Ives comes to a conclusion very considerably different. The composition of a theoretical average daylight, according to Dr. Ives, is very close to that of the carbon-dioxide tube, so near, in fact, that it would undoubtedly be impossible for even a skilled colorist to detect the difference with the unaided eye.

Turning from the purely scientific investigation of the problem to the purely practical, Mr. Moore cites a number of cases where the carbon-dioxide tube has been found after continuous use for some months to be perfectly satisfactory to dyers for matching colors. After all, such practical tests as these are the most convincing. The question of color, as Mr. Jones pointed out in the discussion, is a matter of mental perception. If all the different shades and tints which are now produced in the dyers' art can be matched by experts, long trained in the work, and upon whose decision thousands of dollars in value depend, by means of a certain artificial light, then that light is equivalent to daylight. We do not see how there can be any appeal from the verdict of such a jury.

Mr. Moore states that the carbon-dioxide tube can be made uniform in both color and intensity by the regulation of conditions which are susceptible of a very high degree of accuracy of control, and that therefore the tube meets all the requirements for a standard white light. That the color of the light is white seems to be proven by both theoretical and practical tests. It seems important, therefore, that the means of producing a constant intensity, as well as color, be carefully investigated, to the end that it may be recognized as a standard if Mr. Moore's claims are substantiated. The production of a primary standard of white light is certainly an achievement of which the discoverer may well feel proud, and the value of which to illuminating engineering, as well as to the industries in which color forms an important element, is fully comparable to the production of a standard of intensity.

The Commercial Use of White Light

It, of course, does not follow that the carbon-dioxide tube is the only commercial source of white light. What can be accomplished with other sources by means of suitable color screens or admixtures re-

mains to be seen. The two important things which put the whole subject of color upon a basis of accurate science are, a standard white light and a quick and accurate means of comparing colors. The carbon-dioxide tube and the Ives Colorimeter seem to meet these two necessities completely. The carbon arc, the Nernst lamp, the mantle gas burner, the acetylene flame, the tungsten lamp and the white flaming arc have all in their turn claimed to be the "nearest approach to daylight," or to give "pure white light." The Ives Colorimeter puts a stop to mere vague and unsubstantiated claims, all of which have heretofore shown more or less discrepancies from the truth, and puts the subject on as accurate a basis as the measurement of candle power. Analysis by the colorimeter shows that all of the commercial light-sources, except the carbon arc and the mercury vapor tube, have too great an excess of yellow to render them available as sources of white light by screening off a sufficient amount of these yellow rays without reducing their efficiency to an impractical extent. The carbon arc changes its color composition greatly with the voltage, and any excess of blue can be readily screened off with opalescent glass; so that by a proper regulation of these two variables it should be possible to obtain a commercial white light. The mercury vapor lamp, as Dr. Ives pointed out in another paper, when mixed with 50 per cent. of light from a carbon filament, or slightly over 50 per cent. of light from a tungsten filament lamp will give a white light. As this combination is one of very high efficiency in production it should likewise be an available source of commercial white light.

The claim of "whiteness" for a light-source as an advantage for ordinary use has been greatly exaggerated. As Mr. Clifford brings out so well in his discussion of the subject, printed elsewhere in this issue, a white light is too cold and harsh for what may be called social illumination, such as the lighting of homes, hotels, theaters, churches and other places where social intercourse rather than labor is the first consideration.

In commercial lighting the importance of color distinction is of much less importance than might at first appear; in fact, the cases are comparatively few in which it cuts any figure. Even in the textile industries, where one would naturally think that color perception would be most important, there are only a few operations which cannot be carried on irrespective of color perception. Taking the entire field of illumination, it is doubtful if there is actually one case in a thousand in which it is essential to have white light, or even approximately white.

As compared with whiteness the physiological effect of light upon the eye is of vastly more consequence. Not to see a thing as it looks by daylight, but to see it with ease and comfort to the eyes and in a manner that fulfils the purposes of vision is the all-important question. We have heard much of efficiency and whiteness; it is time now that we hear a little more of looking after the physical welfare of the eyes. To save electric current or gas at the expense of the eyes is mighty poor economy.

"A Crusade Against Light"

Under this caption the Chicago *Examiner* of February 10 contains a caustic editorial on certain objections that have been made to electric signs on one of the Chicago streets. Admitting that electric signs of similar design may become monotonous, the editor says that "still, these signs give forth a cheerful and radiant light, and otherwise dispel the gloom that is apt to enshroud Chicago's thoroughfares after dark," and suggests that "there would be less reluctance on the part of the public to dispense with this species of illumination if the city authorities would contrive to put something in its place. * * * Our "most brilliantly lighted city in the world" is a newspaper pleasantry to be published when news is scarce."

The part that the electric sign plays in adding attractiveness to a city has often before been misunderstood and unappreciated. In the very beginning of the "boosting" campaign to make Denver the "City of Lights," the sign ordinances confronted the boosters as a serious obstacle. Mr. Henry L. Doherty took the matter up, and fired a broadside of his

invincible logic at the city authorities. As a result the ordinances were so amended as to offer no reasonable objection to the use of illuminated electric signs. This accomplished, the making good of the title, "City of Lights," followed at a rapid pace.

The "Great White Way" in New York, the prototype and namesake of numerous other spectacular thoroughfares, owes its name and fame entirely to private electric signs, the lighting of this section of Broadway by the city being scarcely creditable to a country village. The corresponding section of Fifth Avenue has been given over entirely to business. An association formed of the leading merchants and property owners is now making strenuous efforts to attract the crowds by night to this famous daytime promenade; but, although it has already one of the finest street lighting installations in the country, it lacks the attraction of the electric sign, and it is doubtful if any amount of street lamps will ever compensate for the marvelous array of beautiful and spectacular electric displays which constitute one of the principal charms of the "only original Great White Way."

The private electric sign possesses one important element of attractiveness which is wanting in even the most gorgeous of street lighting installations, and that is frequent change. We get accustomed to even the most startling innovations remarkably soon. It takes a frequent "change of bill" to keep up perennial interest. Advertisers who understand the game are fully aware of this, and hence do not allow their devices to pall on spectators by too long continued repetition.

Most of the spectacular street lighting installations recently put in have been the result of the work and, to a large extent, the contributions of the merchants and other business men of the section lighted. It would be equally profitable for such associations to expend at least as much money on really striking electric signs. The real object of a "Great White Way" is to bring crowds into the street at night. Electric signs are at least as powerful incentives to the sightseer as street illumination. It can be said with little fear of successful contradiction that without an abundance of electric signs there can be no "Great White Way" worthy of its name.

Lamp-posts as Architectural Structures

To what division of art does that which is applied to street lamp-posts belong? There are many valid reasons for classing it with architecture. Where the architecture of buildings on a particular street has some general uniformity there is little doubt that the design of the lamp-posts should partake of the architectural features of the buildings. In any event the design should possess the characteristics of strength, permanence and dignity, which are always sought for in public buildings. The word "lamp-post" is hardly adequate to characterize the modern street lighting fixture. By association of ideas the term suggests the makeshift and often ugly contrivances that have served in years past as some sort of a support for street lamps. The architecture of public buildings is always a source of much concern to a city, and so far as possible is the result of at least conscientious efforts to produce the best that can be secured. The lighting fixtures for business streets should equally be objects of careful study, and be unhampered by parsimony. A cheap, temporary or ugly street lighting fixture to-day has no place in any business thoroughfare.

Dr. Holmes sets forth in one of his characteristic short poems the necessity for a man having a good hat:

Have a good hat; the secret of your looks
Lies with the beaver of Canadian brooks.

* * *

Virtue may flourish in an old cravat,
But Man and Nature shun the shocking hat.

To put up shabby lamp-posts in a well-paved street in proximity to buildings of modern architecture is of much the same order of incongruity as wearing a slouch hat with a frock coat. The difference in cost between what is good and what is "cheap" is never sufficient to compensate for the difference in the impression made upon citizens and strangers.

Notes and Comments

How the Campaign of Education for Better Public Lighting Is Being Waged from One End of the Country to the Other

In every issue for the past year and a half we have noted and commented upon one or more new campaigns for better public lighting in some city or town. It is probable that no movement for municipal improvement has ever so rapidly and generally taken possession of the country as this for decorative public lighting. Naturally the daily papers have pushed along the good work with all the enormous power at their command. Happily, good public lighting is something which is above and beyond the control of politicians, and hence party politics has offered no obstacle; rather have all parties been anxious to get in line with the procession.

There are still many cities and towns, especially in the East, that have not yet started the ball rolling for this modern improvement.

The story of how local campaigns have been started and brought to a successful conclusion, as told by the local newspapers, cannot fail to interest every public-spirited citizen in towns that have not yet put in modern installations, and may give valuable suggestions as to how public sentiment can be aroused. The several extracts from editorials and special articles are therefore reprinted as object lessons.

PHILADELPHIA.—Convinced from the results obtained from improvements inaugurated on Market street that improved paving and good lighting are important aids to prosperous business conditions, the Market Street Merchants' Association, at the annual meeting held last night at the Bingham House, placed itself on record as unequivocally indorsing the resolution introduced in Councils, providing for a comprehensive and substantial plan of developing the central avenues of this city from river to river. The resolution reads in part as follows: "If an improved lighting system and modern wood paving is established throughout the central business portion of the city it will prove a crowning triumph among all the achievements of this municipal administration. It will be a policy that cannot in fairness be questioned or disapproved by reputable citizens who have at heart the best interests of Philadelphia."—*Inquirer,* February 9.

A delegation of bankers, merchants and business men called on him [the Mayor] to present a petition requesting wood blocks and better lights for Chestnut street. The petition was signed by more than 90 per cent. of the merchants on Chestnut street, and contains the following: "The business interests of this city can be best subserved by the above municipal improvements, and we feel that the installation of a modern wood block paving such as has already been laid on Market street and a good lighting system should not be denied other important business avenues in the heart of the city."—*Inquirer,* March 11.

Responding to the requests of local business men's associations for better illumination, especially in the heart of the city and on the great shopping thoroughfares of the outlying sections, Councils have arranged to pass at its next meeting an ordinance locating several hundred new electric lights. The bill for the City Brilliant has been prepared by the Electrical Committee and will be presented for consideration by Chairman George W. Kucker. The measure is in accord with the recent suggestions of Chief McLaughlin and the recommendations of Mayor Reyburn that the chief thoroughfares be better illuminated.—*Inquirer,* March 13.

SYRACUSE, N. Y.—The first steps in a movement to make Syracuse the most brilliantly illuminated city in the East were taken yesterday by the Syracuse Lighting Company. Consents from property owners were obtained and agreements made by which the company will erect ornamental posts 50 ft. apart on each side of South Warren street from the company's building, No. 335, north to East Fayette street. Each post will be 12 ft. high and surmounted by five large incandescent electric lights in frosted globes. Seven of these will be erected on each side of the street. Mr. Dudley [of the company] said the installation will be made for two years. The company, he stated, will put up the posts, equip them, furnish the current from dusk to 12 o'clock every night of the year and maintain the installation. The expense to the property owners, he said, would be 15 cents a front foot for a month. Practically every property owner on the street, he said, has entered into the agreement. "This plan of illumination," continued Mr. Dudley, "is in no way experimental. It has been installed in 15 or 20 cities and has

proved so satisfactory that in no instance where it has been tested has it been discontinued. Where a trial has been given the service has been extended, until in many cities it now covers the principal business districts. It is an illumination that is permanent and dignified." The commercial enterprise of the business men of Syracuse and the facts that the Ka-noo-no Karnival is an annual event and the city is holding out inducements for conventions to be held here, Mr. Dudley believes, are sufficient reasons why the system should meet with general favor. He said the company is eager to add to the attractiveness of the city, and he believes when the effects are seen in one block there will be a general demand for the lights. The expense of 15 cents a front foot will be $3 a month for a 20-ft. frontage. As one result of this method, Mr. Dudley believes, there will be more individual illuminations by the merchants in the streets affected. He said it will in no way interfere with the illuminations for the Ka-noo-no Karnival or other special occasions, but will materially add to the effectiveness of the displays. For permanent decorations, he said, he considers the ornamental posts and their lights more attractive and dignified than strings of incandescent lamps.—*Post-Standard.*

DAYTON, O.—Every week some city is noted as having installed the ornamental boulevard lamps that have been suggested for a long time for use in Dayton. It was expected to have had these boulevard lights installed long before this, but the difference in opinion as to ways and means of installing same and the desire on the part of the citys' officials to give every one interested a chance to express their views have been responsible for much of the delay.—*Herald.*

SALEM, ORE.—If the strenuous work that has been done lately by Mayor George F. Rodgers is any criterion, Salem streets will be lighted with ornamental cluster lights. Mayor Rodgers is of the belief that when this system is installed, the posts used should be cast and of an artistic design, and that the best plan for lighting the city in an adequate and artistic way, aside from the arc lights, is that the property owners get together and buy posts of a good design and put them up, and he believes that if this was done and the property owners also stand half of the expense of lighting that the city could be brought to provide means for the other half of the expense. It is one of Mayor Rodgers' ambitions to see Salem the City Beautiful, as it is by nature endowed, so it is his hope to make it more so by all the assistance he can give.—*Statesman,* March 4.

Mayor Rodgers is carrying the question of cluster lighting directly up to the City Council, as the following message he has fired into that body indicates: "Inasmuch as a number of property owners have signified their desire to install cluster street lighting posts along the business streets of the city, affording a fitting and beautiful means of illuminating the public thoroughfares, I believe the city should co-operate in the movement in every consistent way. I would suggest that the Council, by ordinance, adopt a uniform design of street post to be adhered to by all desiring to install the service. Accompanying this communication I am submitting several designs for your consideration."—*Statesman,* March 8.

PEORIA, ILL.—The Peoria Merchants' Association has appointed a committee to investigate the question of street illumination. The committee will report at the next regular meeting regarding the cost and plan for installation.—*Journal,* February 25.

At a meeting of the Retail Merchants' Association last evening, in which reports on the ornamental cluster light proposition on Adams street was made, it was shown that over 75 per cent. of the property owners from Hamilton street to Chestnut had affixed their signatures to an agreement favoring the project.—*Journal,* March 4.

Reports from six of the committees of the Merchants' Association on the ornate light proposition on South Adams street were made yesterday noon at a meeting in the association room, with Fred H. Putnam as chairman. When the illumination project was taken up two committees were appointed for each of the seven blocks to be beautified with the ornamental lights, one for each side of each block.—*Journal,* March 10.

Final decision on the proposition of installing ornamental lights on Adams street from Hamilton to Bridge streets will be taken by the Merchants' Association at a meeting to be held Tuesday night. The committee from the asssociation informed the merchants that the cost will be $2 per front foot and the current will be supplied by the city. George E. Green, retiring secretary of the association and secretary of the State association, and who returned from Des Moines Friday night, will give the merchants a few ideas as to the ornamental lighting proposition which he studied while in the Iowa capital.—*Journal,* March 13.

Circulars announcing a special meeting of the committees on ornamental illumination of South Adams street were sent out yesterday by Secretary George E. Green of the Merchants' Association. The meeting will be held Friday afternoon at 1 o'clock, at which it is expected final arrangements for the project will be completed.—*Herald-Transcript,* March 17.

ALLENTOWN, PA.—Seventy-five per cent. of the merchants and property owners with frontage on Adams street along the route of the proposed ornamental lights have appended their signatures to an agreement to pay their share of the cost of installing and maintenance. This gratifying status of the cluster light project was revealed at a meeting of the Retail Merchants' Association last night, at which reports of meeting to cam-

paign among those who will bear the expense of lighting were submitted. Practically no difficulty was encountered in securing the names and none is anticipated in obtaining the signatures of those as yet unsolicited.—*Item,* March 4.

OTTAWA, ILL.—The proposition to provide suitable approaches to the new bridge and to properly light the same is meeting with a great deal of favor from all classes of the people. It is not only a good thing in itself, but, as is pointed out elsewhere in these columns, it may lead to further improvements in the lighting of the business section of the city that will be very admirable in many ways. Plans for the proposed lighting system are now being prepared by Architect Jason F. Richardson and Architect Kesson White. When completed these plans will be exhibited in the windows of the Lutz Pharmacy that the public may have an opportunity to see how it will look, provided it is successfully carried out. The people will have more than pictures to look at; also to determine whether they want to try such a plan. With his customary public spirit L. W. Hess has sent for a sample of the ornamental lamp-posts that have been used in carrying out such lighting systems in other cities. It will be placed in position in front of the Armory building. Then people will have a clearer idea of what it means.—*Free Trader,* March 4.

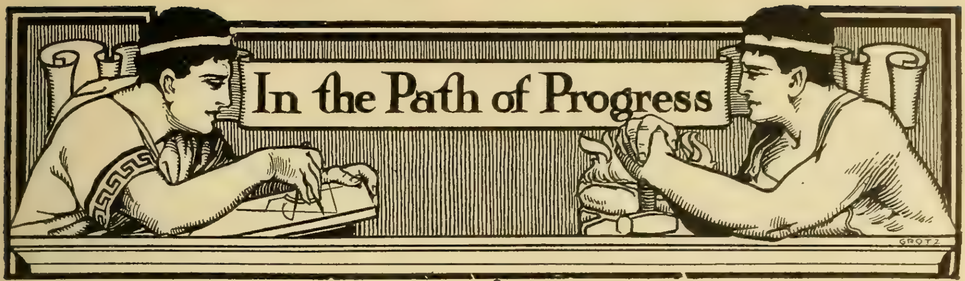
NEW YORK.—Although only one block in Fifth avenue, between Thirty-eighth and Thirty-ninth streets, was well illuminated last night, the officers of the Fifth Avenue Association who have been advocating this project for some time said they were satisfied with the impression it made on them, and they would make every effort to put into immediate effect the lighting of the entire avenue. The object is to make the avenue as prominent a place at night as it is in the daytime, and also to prevent "hold-ups."—*Tribune,* March 16.

CAPE MAY, N. J.—The Council at a special meeting last evening instructed the city engineer to prepare plans and specifications for the proposed new method of lighting the Boardwalk, which is to be by numerous ornamental arches, clusters and strings of incandescent electric lamps.—*Philadelphia Record.*

KANSAS CITY, MO.—"As a member of the light and car committee of the McGee Street Improvement Association, I can say that I will be able very soon to make an announcement of an improvement North McGee is to get that will be of such a character it will make the whole town open its eyes," said George Neff at a meeting of the members of the association. This statement was greeted with applause.—*Journal,* March 12.

HOT SPRINGS, ARK.—A full-grown mountain, lighted uphill and down by 60 cp. electric lights, is a most unusual spectacle, even in this electrical age, yet it is now an accomplished feat. When it comes to lighting a whole mountain side, every night in the year, it makes one hesitate and reflect, but that is what has been done to the south spur of Hot Springs Mountain. The Federal Government is the power that has done this, the paramount intent being to protect the medicinal springs here from any possible harm by wanton miscreant or mentally unbalanced wanderer.—*Los Angeles Examiner,* March 6.

INDIANAPOLIS, IND.—Members of the East Washington Street Merchants' Association, at a meeting yesterday afternoon, decided to install the new lighting system along the street, completing a chain of lights from Illinois street to East street. Mayor Shank was present at the meeting and urged the merchants to become a part of the movement for better lighting in the downtown district.—*Star,* February 19.



General Progress During the Past Year

The following letters on the year's progress were received too late to be included in the forms of our last issue:

From J. D. Hoit, Engineering Department, National Electric Lamp Association, Cleveland, Ohio.

During the past year illuminating engineering has made greater strides than ever before. Although it is still in its infancy the fruits of its past labors are already affording a stimulus for more extended and more rapid development. Its present and future success depends not a little upon the co-operation of the lamp and reflector manufacturers in furnishing the illuminating engineer, so to speak, with the tools of his profession.

Two factors have done much to accelerate the already rapid progress of illuminating engineering.

In the first place the public is beginning to recognize that there are proper and improper methods of utilizing light. It has seen the gradual improvement in lighting which resulted from the development of the light source from open flames to incandescent mantles and electric incandescent lamps of the carbon filament type. Now it has placed at its disposal the high efficiency tantalum and Mazda tungsten lamps and various reflectors which make it possible to still further greatly increase the efficiency of a lighting system by directing the light where it will do the most good. It has learned that it is possible for the illuminating engineer to produce cheaply an abundance of pure white light which can be directed so as to obtain the desired distribution and artistic effect without bringing the source of light directly within view. The many advantages that can be gained by use of the high efficiency units more than offsets any slight trouble which may arise from the substitution of the new for the old, and the satisfaction and benefit which is derived from a better lighted home, office or store can hardly be expressed in dollars and cents. In the second place we have, as another factor helping to increase the popularity of correct lighting, the lamp and reflector manufacturers working in unison to produce the best lighting unit for each and every condition of service.

Illuminating engineering is already being specialized under several general classes, such as street, industrial, marine, train and car, and general lighting, the last including all usual residential and commercial lighting, such as for stores, offices, residences, etc.

In order to consider briefly the progress of illuminating engineering during the past year for convenience and simplicity let me treat this subject under these six heads and thus present the most important phases of each.

During the past year the consensus of opinion that the main object of street lighting was to use higher candle power lamps spaced at random seems to have gradually died away, and in its place there has sprung up the idea of gaining a more evenly distributed illumination by the proper spacing of lower candle power units. Numerous cities and towns have adopted the " More Light " slogan and have installed a great many of the lower candle power multiple and series Mazda lamps on the principal streets and even in some cases throughout the entire town. The success with which this form of street light has met has exceeded all expectations.

The light units have been placed either on standards on the curb line or on arches placed across the street, and from a decorative standpoint have added materially to the general appearance of the streets so lighted.

Industrial lighting has been somewhat neglected until recently. Formerly a workman had to put up with what he could get in the way of illumination, and that varied from a little stray daylight sifting in through a dust covered window to a smoky kerosene lamp, or at the best a carbon lamp placed so as to throw as much light in his eyes as on his work, the lamp itself becoming dimmer and dimmer until broken or burned out. Factory and shop men are just awakening to the fact that better lighting facilities provided for their employees means both improvement in quality of output and increased production. Very recently there has been some agitation in favor of the use of low voltage metallic filament series lamps in industrial lighting in place of the usual multiple type where excessive jar and vibration is met with, because of the greater size and strength of the low voltage series lamp filament. This is a system which has its merits and may be given consideration when conditions are a little adverse to the use of the regular multiple lamps. It might be said, however, that shock absorbers are now on the market which serve to protect the multiple lamps from mechanical breakage.

Marine lighting, which has remained unnoticed until of late, is now being given considerable attention, and through the process of substitution, even though it is somewhat slow, we will ultimately find tantalum and Mazda tungsten lamps used in place of the old time carbons.

Train lighting offers a great field to the illuminating engineer, probably because the lighting conditions of railway coaches remained practically the same for many years while various improvements of other kinds were introduced to make the cars as luxurious as possible. The economy of a high efficiency electric incandescent lighting system is recognized by the railroads and its many advantages are appreciated by its patrons. The lighting systems of many old cars are being changed over to electricity, while several roads are equipping practically all new cars with this modern method of illumination. The street car lighting field, so long occupied exclusively by the low efficiency carbon lamps, is being successfully invaded with tantalum lamps. The tantalum lamp makes it possible to maintain a much better average illumination of the cars on the poor voltage regulation common in street railway work because the candle power of the metallic filament lamp is not as greatly affected by such voltage changes as is that of the carbon.

As for general illumination, the greatest development has perhaps been in commercial work. The merchant realizes that the general appearance of his whole store depends very greatly upon its proper lighting and that the illumination must be pleasing to the eyes in order to attract attention to his goods , and of good quality to show them in their true color values. All this results in added revenue. As a rule we find the progressive merchants fairly flooding their stores with light in order to make them attractive to the general public.

Likewise the office manager has found that he can obtain much better work from those who have proper illumination than from those working in semi-darkness.

The correct lighting of homes is perhaps a more difficult problem than any other, and has been given a great deal of thought and consideration during the past year. Where once we were contented to have a light source of low intensity, poor distribution and color value, we now aim to have not only the entire room well lighted but to produce a light which is so distributed as to be soothing to the eyes and to bring out in the best manner the artistic features of the decorations. The fixture manufacturers deserve great credit for their efforts to place both artistically and correctly designed fixtures at the disposal of the illuminating engineer.

The fact that the tantalum lamp in its present form offers great resistance to mechanical breakage enables it to be used in portable lamps for home and office as well as in street cars, as already noted.

Without any question the development of the high efficiency lamp has been a

great factor in popularizing electric lighting and their further perfection will be of still greater benefit to the illuminating engineer.

The Mazda lamp embodies every development which science and the best efforts of man can produce. At present the filament is made of especially prepared tungsten, but Mazda does not mean necessarily that the filament must always be of this metal. It means that the lamp is to represent at all times the highest development of the incandescent electric lamp.

The reflector manufacturers, as well as the lamp manufacturers, have been constantly striving to increase the quality and efficiency of their product, with very gratifying success. The market to-day contains many reflectors which add materially tc the utility of the lighting unit. The prismatic glassware reflectors and other scientifically designed reflectors are being used very generally in modern stores, offices, residences, etc., and the light distribution obtained from light units so equipped has been more than satisfactory. The public is beginning to understand that any haphazard shade will not produce the results possible to secure through reflectors which are designed primarily to distributing the light in the most useful manner. Asymmetrical glass reflectors are being used to a considerable extent in street lighting and are also very serviceable in installations where lamps are near to walls or posts, etc., and it is desired to direct a large part of the light in one general direction.

Although the general public and all users of light have accepted the Mazda lamp as a highly efficient and economic means of producing light, yet there is one great industry which is seriously concerned in the matter and which, unfortunately, is not in a position to advocate the general adoption of high efficiency lamps to the entire exclusion of carbon. This industry is the central station industry. The entire lighting revenue of a great many central stations is derived very illogically from the number of kilowatt hours they sell. When the customers of a central station who are on a straight meter rate substitute Mazda lamps for the older carbon lamps a decrease in their bills inevitably results even though they should obtain 50 or even 100 per cent. more light. Any decrease of the number of kilowatt hours that the station sells in such cases operates to reduce its profit, for there are certain fixed expenses, such as interest on the investment, taxes, depreciation, line repairs, etc., that are not decreased by a decrease in the sales of electricty and hence are not decreased in proportion to the decrease in revenue if the energy is sold at a straight meter rate. With an inevitable loss of profit staring him in the face, it is not to be wondered that the central station man who charges for energy on a straight kilowatt hour rate without any fixed charges dislikes to see high efficiency lighting units brought into general use upon his circuits.

There is at the present time being felt considerable agitation among central station men in regard to changing existing meter rate systems of charging to some other system under which the charges to the customers will be made in the form of certain fixed amounts, depending upon the actual cost of serving them plus a charge for energy at a kilowatt hour rate much lower than that now prevailing. This low kilowatt hour rate would of course be made possible only if the fixed expense would be covered in some other way.

If systems of charging for electrical service should become general, which would assure the central stations their incomes regardless of the kind or size of lamps used by their customers, instead of regarding the high efficiency lamps with indifference they would then be in a position to derive considerable benefit from the use of such lamps upon their circuits and would consequently urge their customers to adopt a more efficient illuminant.

This would inevitably lead to more profit to themselves, would lower the cost of light to the consumer, and would extend the use of electric light in general. All of which would be of direct benefit to the illuminating engineer.

From Arthur Williams, General Inspector The New York Edison Company, New York:

It is our opinion that in the art of electricity nothing within the past year

has been more marked and beneficial than the exceedingly rapid advance in the science of illuminating engineering. The electrical contractor and the public appear to more fully realize that the scientific installation of lights and the use of proper reflectors is of value not only from an esthetic but primarily from an economic standpoint. The newer forms of high efficiency illuminants make it possible to now secure an attractive, harmonious and uniform illumination for a fraction of the cost of a few years ago.

The anticipated reduction in the prices of the Madza or tungsten lamp will undoubtedly attract many who have heretofore been deterred from remodelling their installations on account of high cost. Worthy of attention is the fact that wherever the newer forms of lamps are used the method of installation is the result of much thought in securing efficient and satisfactory illumination on the part of the contractor as well as the consumer.

That this is the case is apparent by the improved appearance of stores and store windows throughout the entire city. In this connection it might be of interest to know that at the present moment we are negotiating with the proprietors of various stores on one of the principal thoroughfares in this city in the hope of bringing about a uniform and dignified system of window lighting throughout the entire avenue.

Without doubt the standard of illumination has been raised, and it is reasonable to expect still greater strides during the coming year.

From Robert B. Ely, Illuminating Engineering Department, the Philadelphia Electric Company, Philadelphia, Pa.

The progress made in illuminating engineering in Philadelphia is worthy of note, both from the commercial and civic standpoint. We have, within the past year, served many of our customers through the Illuminating Engineering Department, keeping well in mind that the best advertisement is a satisfied customer, and submitting plans and specifications for reconstructing existing installations, whereby the average consumer has increased his lighting without an increased bill for current. We have also found that in soliciting new business complete plans of the installation and specifications are of great assistance in closing contracts, and starting our consumer in the right direction, and our maxim, as far as new business is concerned in the Illuminating Engineering Department, is, "Maximum illumination at the minimum cost," with due and appropriate attention to the decorative and esthetic features.

The average merchant is alive to the topic entitled "Illuminating Engineering," and the general tendency is to obtain the services and to apparently see if the illuminating engineers can be of use, and they realize they can, as is indicated by the great number of reconstructed installations that can be seen on almost any of our streets.

The tungsten lamp has been the particular booster in this respect, and in the coming year we look for decided advancement, owing to the introduction of the Mazda tungsten lamps, and the gradual but steady improvement in the lamp. A new field that has not been exploited to any extent as yet is the use of 4 C. P., 5-watt tungsten lamps for showcase lighting, installing 10 low voltage tungsten lamps in series on 110 volts. This will be a particular field for increasing the load, owing to the low operating cost, making it possible in numerous instances to illuminate a showcase for a consumption of 50 watts per hour. With the improved fittings for absorbing vibration and shock, our field for the introduction of tungsten lamps has been extended and the demand will no doubt increase in proportion.

From A. Cressy Morrison, Secretary International Acetylene Association.

Acetylene as an illuminant has made such progress in the past year that it will certainly arouse the attention of all those who are engaged in the production and distribution of the visible rays of the spectrum.

Early in the year the United States Government investigation disclosed the fact that acetylene, burned as an open

flame under the ordinary conditions of every day use, was the nearest approach to sunlight. The highest expressions of genius in the production of light from electricity or from gas, while comparing favorably with acetylene, were found to be but exquisite flanking jewels in the diadem which crowns man's efforts to set the ether of space into vibrant oscillation in unison with the sun.

When one considers the studentship in physics, the chemical research and the engineering talent which find their expression in the delicate filament enclosed in the electric bulb or gives heed to the nice adjustment which makes the mantle burner such an expression of practical and economic utility, one must bow in almost reverent awe to the mastery of mind over matter which could have produced them.

Without forgetting the debt which we owe to electricity in the production of calcium carbide, or to engineering talent in the production of the mechanically ingenious acetylene generator and the delicately adjusted burner, we find acetylene as the queen of illuminants at the very starting point from which all other illuminants have progressed. What, then, does acetylene promise us? What has the future in store for her? Will she not, when subjected to the searching investigations which have wrought such wonders in other fields, yield to us the secrets which will not only keep her in the van, but perhaps place her far in advance?

To those unfamiliar with the acetylene industry, the widespread use of this illuminant for domestic purposes is little understood. Of course, in comparison with the established illuminants of the world, kerosene, city gas and electricity, acetylene is but an infant. Still, during the past year in the United States something over 25,000 separate installations of acetylene generators have been made in country homes. Three hundred and fifty towns in the United States are illuminated by acetylene, and nearly fifty of these towns have been added during the past year.

Several thousand locomotive headlights have been added to the equipment of the railroads of the United States and the tendency to the use in this direction has received a great impetus.

Acetylene among the illuminants stands foremost in the automobile industry, and this is perhaps the field in which most people become familiar with acetylene.

Acetylene is being adopted with increasing rapidity for the illumination of yachts. The automobile and the yacht, while constituting a conspicuous field, are, however, unimportant uses when compared with the large consumption of acetytlene in the country home.

In dealing with the domestic use of acetylene, its use in town lighting and in hotels and institutions, it is only necessary to say that upward of 175,000 installations are in use each night in the United States, and that this use is rapidly increasing, to show that the industry has practical and economic advantages which are destined to carry it forward to a practically unlimited extent.

The acetylene generator has been developed mechanically to such perfection that it is now recognized as a simple, efficient, economical and very safe means for the production of radiant energy in the home. The perfected generator is but a matter of the last few years. The last five years have shown great progress, and even the last year has brought into existence notable improvements. The advance toward simplicity and economy and the increasing safeguards which now surround the construction of the acetylene generator forms a basis so sound that what we may call the progress of the past is merely the laying of a foundation on which a really great industry can safely rest.

The number of salesmen in the field urging the use of acetylene has certainly doubled in the past year. Confidence in the stability of the industry has extended from those whose familiarity with the subject made them cognizant of the possibilities, to many who had not realized the amazing expansion which was the destiny of acetylene, and these have joined forces with the pioneers and are now working shoulder to shoulder for the advancement of acetylene.

Investigations during the past year have disclosed the fact that for locomotive headlights acetylene is far superior to other illuminants. Its certainty, the absence of blinding glare, the fact that it

shows signals in their proper colors and the range of vision is sufficiently extended, together with the penetrating power of acetylene in fog and mist, have induced the railroads to equip locomotives by the thousand. There seems to be no reason to suppose that the progress in this direction will not continue until the railroads are using acetylene headlights as freely as they are used in the automobile industry. The use is economical, safe and effective. It has the approval of locomotive engineers whose practical requirements have apparently been fully met.

The progress of acetylene throughout the world has been as notable as it has been in the United States, and it is gratifying that not only in the United States, but elsewhere, a tendency toward the standardization of pressures, burners and all phases of the utilization of acetylene is in progress. It may gratify American pride to realize that America has the highest grade of calcium carbide produced anywhere in the world. The industry was born in America and the production of calcium carbide and the manufacture of acetylene generators has from the beginning been so rapidly developed toward perfection that, in spite of the enormous advances made abroad in both departments, the Americans have maintained their lead.

There are now in operation some forty-three factories for the production of calcium carbide, and it may be truthfully said that in the efforts to harness the undeveloped water power of the world, the manufacturers of calcium carbide are as active as any other industry.

The development of the incandescent mantle for use over acetylene has made considerable progress abroad and soon promises to become a fact in the United States. Recent tests with a foreign mantle disclosed the fact that, burning one foot of acetylene per hour, upward of one hundred candle-power was produced in a mantle not much larger than one's thumb. This, together with the probability of the ultimate standardization of pressures in this country to three inches instead of 2.7 water pressure, will undoubtedly extend the use of acetylene in many quarters where it is not now available.

The year just past has been one of remarkable awakening to the fact that the principles on which the progress of acetylene must rest have now reached a sound basis, and one who is familiar with the subject can scarcely restrain an exclamation of enthusiasam when he contemplates what the next ten years may mean in the development of the acetylene industry.

From W. H. Spencer, Illuminating Engineer, I. P. Frink, New York.

Illuminating engineering as a separate branch of practical engineering has made notable progress of late, inasmuch as it has demonstrated that by the application of its teachings, designs can be worked out which not only satisfy certain specifications, but also can be made the basis of rigid guarantees. We are now able to design reflectors, which follow the rules of theoretical illuminating engineering in an almost ideal manner, and by the use of the well-known corrugated mirror glass as the reflecting surface, they embody the highest degree of efficiency and offer facilities to approach as nearly as possible the physical rules of reflection. They thus render the predetermination easy and reliable, and make engineering designs practical and successful.

Engineers and architects desiring spe-

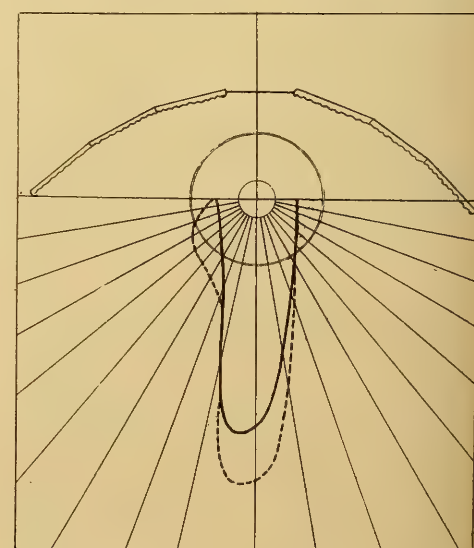


FIG. I.—CHARACTERISTIC PHOTOMETRIC CURVE FROM A FRINK REFLECTOR.

cial effects in illumination and recognizing the importance of properly designed reflectors demand specially designed reflecting devices for which certain characteristics and requirements are specified, and nearly all the high-class engineers go even as far as to carry out the engineering designs themselves, and insist then that the work be carried out by I. P. Frink.

This shows an important development in illuminanting engineering and the engineering feats obtained thereby must be considered as quite an achievement, while the practical realization of theoretical engineering ideas ought to prove an aid and a boon to the progress of this advancing profession.

For this reason it will interest the reader to get a general idea as to the character of the work done by the firm of I. P. Frink, and as to the astonishingly exact results obtained thereby.

It is a comparatively long time since when one did realize that, for instance, in the case of show window lighting, it would be wrong to use the same reflecting devices for high and narrow windows as for low and deep ones. The designs were then tried out by approximate determinations on the drawing board in connection with the experience derived from practical installations. Still there was no sound basis for an intelligent design, nor were there any practical tests on hand which could verify the correctness of the original design. To-day the conditions are entirely changed. There is not only a large number of photometer and illuminometer tests to guide the designing engineer, but there are also methods which enable him to calculate the expected results with very close approximation. The accompanying sketch shall illustrate this, all the more as it represents a case of show window lighting for which a rather interesting specification was made and for which an exact solution was of great importance.

The window is high and narrow (10 ft. by 4 ft.), and sufficient illumination all over the window was required. The theoretical light distribution curve as corresponding to the design is indicated by the full drawn line (Fig. 1). It checks extremely well with the dotted light distribution curve as derived from the illuminometer tests, which were taken after the reflector was installed. It shows that the character of the light distribution curve was very well met with, considering that the reflection from front and back window has to be taken into account.

Such designs can be worked out only if the proper attention is paid to the engineering end, and the facilities at the disposal of I. P. Frink in this direction are unlimited.

A Really Good Electric Table Lamp

Of electric portables there has been no lack of designs and prices. With all this variety, however, there has been almost no attention given to the practical illuminating results obtained. "Portables" have been considered as either pieces of bric-a-brac or as electric substitutes for the old-time kerosene lamp. The result has been that one of the really best of lighting devices for home use has been utilized far less than its possibilities for good illumination demand. Messrs. Marshall and Godinez have been the first to take up the problem from an illuminating engineering standpoint; and those who know Mr. Marshall, either personally or by reputation, will at once understand that the artistic side of the problem has by no means been neglected.

THE G-M LAMP, SHOWING CONSTRUCTION.

The lamp, as shown in the accompanying illustration, consists of a metal standard, or base, of pleasing design, supporting a Holophane or other diffusing globe, which is surmounted by an art glass shade. A single tungsten lamp is used as the light-source. By means of a resistance in the base operated by a small lever placed at the side the brilliancy of the lamp can be lowered to practically any desired degree. The Holophane globe distributes the light, while at the same time removing the glare, while the art glass shade gives to the lamp a very pleasing and artistic effect.

An important point is the fact that the standard is of a sufficient height and the shade so adjusted as to give a wide angle of distribution, thus producing a large illuminated area, while not allowing the direct rays to shine into the eyes.

As compared with the ordinary portable, which is sometimes supplied with four or five carbon incandescents, this lamp, which is known as "the G.-M. lamp," is from three to six times as efficient.

The lamp will be supplied in a number of designs of base and shade, and at prices which will place it within the reach of many of those who have been deterred from using table lamps heretofore for the reason that either something cheap looking must be purchased, or an undue amount expended for artistic effects which too often make the lamp almost useless for practical purposes.

The G.-M. lamp is manufactured and sold to the trade by the Electric Motor and Equipment Company, 232 Market street, Newark, New Jersey.

The Value of Moving Effects in Electric Signs

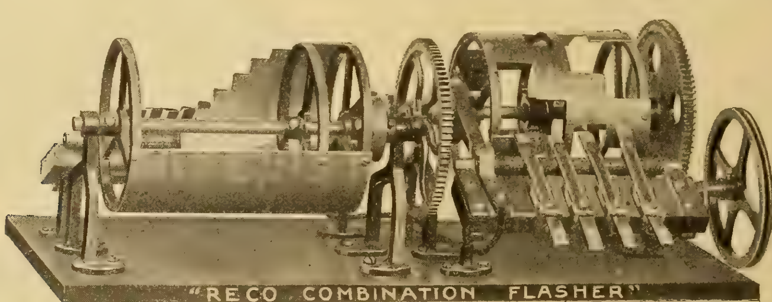
The attraction of moving objects seems to be irresistible. The simplest kind of device for motion display in a store window will invariably have a crowd of spectators on the outside. The same natural tendency is displayed in electrical shows and other similar expositions where the exhibits showing machinery or apparatus in operation are invariably crowded to the limit.

Motion effects in electric signs have been brought to a remarkable state of perfection, the credit for which rests largely with the designers and makers of the flashers or switching apparatus, by which the effects are controlled.

One of the pioneer manufacturers in this field is the Reynolds Electric Flasher Manufacturing Company of Chicago, who have steadily added to their reputation for the ingenuity and excellent design of workmanship of their flashers. A typical example of their work is shown in the accompanying illustration. If you could get behind the scenes of all the spectacular electric signs you would find a flasher bearing the word "Reco" in a very large number of cases.

Mazda vs. Tungsten

A brief explanation of the significance of the term "Mazda," as applied to incandescent lamps, was given in our last issue. It appears, however, that this explanation did not fully cover the ground, in that the lamp manufacturers contributing to the general fund of scientific knowledge is much larger than was stated. We



THE "RECO" COMBINATION FLASHER.

are indebted to the General Electric Company for the following information:

Mazda is the seal or brand of a plan of exchange of information of the greatest importance to the rapid development of the art of manufacturing metal filament lamps, making possible in a brief period what would otherwise take a score of years to accomplish. Work of great importance to the development of metal filament lamps has been in the past and is continually being accomplished in the laboratories and factories of such companies as the

Deutsche Gasglühlicht Aktiengesellschaft of Berlin, manufacturers of the Osram lamp;

Dr. Hans Kuzel, of Vienna;

Internationale Wolfram Lampen Aktiengesellschaft of Berlin (Dr. Alexander Just and Franz Hanaman);

Julius Pintsch Aktiengesellschaft of Berlin;

Vereinigte Glühlampen and Electricitats Aktiengesellschaft of Vienna;

Bergmann-Elektricitats Werke Aktiengesellschaft of Berlin;

Dr. Sigmund Bergmann of Berlin;

Glühlampenfabrik Johann Kremenezky, Vienna;

Allegemeine Electricitats Gesellschaft of Berlin; and on this side in the laboratories and factories of the General Electric Company, National Electric Lamp Association and those other companies which have become entitled to all of the knowledge and experience of all these companies in this line of work. All that has been done, and immediate information of what may be accomplished in future, by all of the above mentioned companies, is available to those manufacturers entitled by contract to receive this technical and engineering service, and they are the only ones who have the right to use the trade-mark "Mazda."

While the filaments in Mazda lamps are at the present made from the metal Tungsten, the filament will not be restricted to this or any other particular metal, as it is intended that the Mazda lamp shall be continuously improved so that whatever may be found best suited for the production of the highest grade of metal filament lamps may be designated by the trade-mark "Mazda."

The Tungsten label on a lamp has in the past, and may in the future, indicate only the metal of which the filament is composed. Mazda, however, is the hall mark of quality and progress in metal filament lamp manufacture, or the seal of world-wide co-operative effort to produce the best.

"How to Figure Illumination"

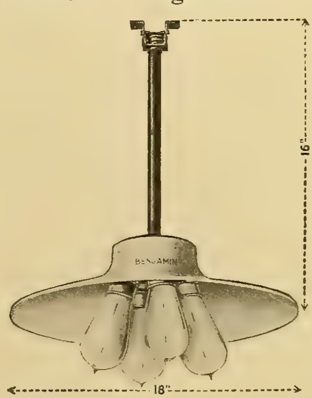
The above is the title of a pamphlet recently issued by the Sunbeam Incandescent Lamp Company, of Chicago and New York. It is the purpose of this pamphlet to reduce the problems involved in calculating illumination to such simplicity that any one capable of handling arithmetic can make the necessary calculations. The instructions given are exceedingly plain and simple, and the tables of data are of real value.

That the Sunbeam Incandescent Lamp Company do not expect that the perusal of the five pages of matter given will constitute the reader an illuminating engineer is shown by their inviting all who encounter problems that are beyond their reach to submit them to their own illuminating engineering department. The pamphlet is sent free to those who ask for it, and is really a valuable piece of engineering literature.

The Use of Street Series Tungsten Lamps for Industrial Lighting

The advantage of using the tungsten lamp in series are well recognized, the result being a practical doubling of their life, and their ability to withstand much rougher usage by reason of the coarser wire used in the filament.

The Benjamin Electric Manufacturing Company have recently brought out a fixture especially designed to secure these advantages for industrial lighting installations. The fixture is shown in the illustration, and is adapted for burning 27½-volt lamps on 110-volt circuits. The lamps are set at an angle of 16 degrees from the vertical, and the fixture is supplied with a white enameled steel reflector. A shock absorber is also provided at the upper end of the stem. It is needless to say that the material and construction will be fully up to the Benjamin standard, which is all the guarantee needed.



THE NEW BENJAMIN TUNGSTEN CLUSTER FOR INDUSTRIAL LIGHTING.

Proceedings of Technical Societies

The Illuminating Engineering Society

At the March meeting of the New York section three unusually interesting and valuable papers were presented. The first, by Mr. C. R. Clifford, on "The Relation of Decoration to the Illuminating Engineering Practice." This will be found printed in full in another section of this issue. Second, on "A Standard for Color Values—the Moore White Light," by D. McFarlan Moore. The third, on "The Color Values of Artificial Light—a Résumé," by Dr. H. E. Ives.

Mr. Moore's paper gave a brief history of the development of the vacuum tube light and particularly set forth the claims of his carbon dioxide tube as a standard for white light. Numerous references to the experience of practical dyers and to the opinions of scientists were given.

Dr. Ives gave a general survey of the research work that has been done to obtain a standard value for "average daylight." It is noted that the value which he arrived at himself is considerably in variance with that given by Dr. Nichols in a paper presented two years ago.

The February meeting of the Boston section was devoted to an address by Mr. L. B. Marks on "Factory Lighting." Mr. Marks discussed the daylight illumination as well as the artificial, and described cases where great improvement had been made by the use of prismatic glass in windows. Installations using various methods of illumination were also described and compared.

At the February meeting of the Chicago section Mr. Preston S. Millar gave an address on "Recent Developments of Modern Luminants." Mr. Millar went over the entire subject, including oil and and alcohol lamps, gas, acetylene and electricity.

The Annual Meeting of the New England Association of Gas Engineers

A paper was presented on "Some Single Unit Installations" by Mr. Benjamin J. Bean. The writer gives very complete engineering data on a number of installations in which single inverted gas burners were used.

Society of Municipal Improvements

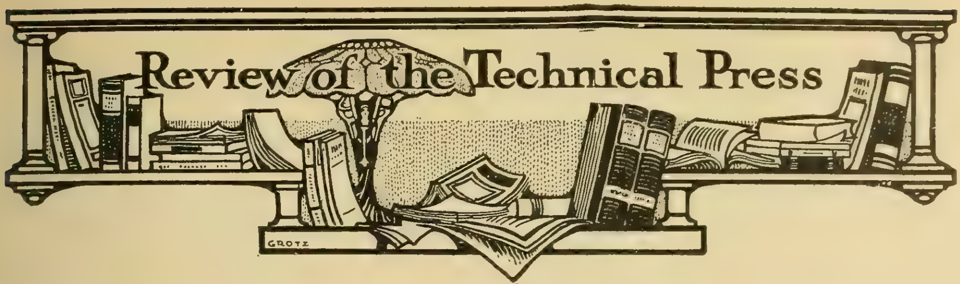
At the recent annual convention of this association Dr. Louis Bell presented a short paper on "Street Lighting," devoted chiefly to pointing out defects in the systems commonly found in this country.

Chicago Ophthalmological Society

Visual Requirements of Transportation Employees, by Dr. Nelson M. Black.

Dr. Black has perhaps given more special study to the question of testing the organs of vision than any contemporary writer, and his paper on this subject contains a great deal of carefully prepared and valuable information on this important subject. He divides the subject into five inquiries, as follows:

1. Is there a necessity for examination of transportation employees as to their vision and color perception?
2. What amount of vision and what color perception is actually necessary for such employment?
3. What visual acuity and color perception should be required of transportation employees?
4. Who should decide whether an applicant for employment or for re-examination meets with the required standards?
5. Should old employees requiring glasses to bring their vision up to the required standard be retained in service and also retain their grade in line of promotion?



American Items

Heterochromatic Photometry, by David Edward Rice; *Electrical World,* February 24.

Mr. Rice gives the preliminary results of experiments which he is carrying on in the Psychological Department of Columbia University to determine the luminous effects of colors; in other words, to differentiate between the effect of brightness of a given color, the color sense itself. Observations were made by a number of observers, the flicker photometer being used for the purpose. Tabulated results were given, and the writer states that the experiments will be continued, using colored electric lamps in place of colored papers.

Note on Diffusing Shades, by Dr. Louis Bell; *Electrical World,* February 24.

Dr. Bell gives the results of reflectors of similar shape, made in opal glass and of prismatic glass sand blasted on the inside.

Graphical Method of Solving Certain Problems in Illuminating Engineering, by Albert F. Parks; *Electrical World,* March 24.

The writer deals particularly with cases in which lamps or units are placed at an angle instead of in the vertical position. The method is developed mathematically according to the laws of projection and trigonometry.

Electric Lighting of the New Theatre, New York City; *Electrical Review and Western Electrician,* March 19.

An illustrated article describing the lighting and the general equipment of this most elaborate and elegant of American playhouses.

Investigation of Methods of Car Lighting, by Edward Wray; *Railway Electrical Engineer,* March.

A continuation of the serial article, as before noted.

New Lighting in Modern Buildings, by Newton Harrison; *The Central Station*, March.

The article gives a brief statement of many well-known facts, among which is the greater economy possible with metal filament lamps. The writer shows how it is possible to largely increase the lighting where the plant is already running at full load without putting in additional generators.

Relamping the Church Cross, by A. Larney; *Selling Electricity,* February.

Describes the method devised by the pastor of Holy Trinity Church, Dayton, Ohio, for renewing the lamps in the illuminated cross surmounting the church spire. The method is thus described:

"The lamps are screwed into receptacles mounted on three flexible belts, equipped with a series of rope guides and pulleys by means of which the whole electrical installing can be lowered from the cross down into the interior of the spire. When in place the belts lie flat against the sides of the cross, with the lamps projecting at right angles to the usual arrangement. Therefore, the sides of the lamps are visible from both sides of the cross through the glass face plates, in which wire mesh is imbedded to prevent the possibility of any accident as the result of falling pieces should the glass be broken by

storms or stray bullets. The operation is so simple that the belts can be drawn down from the cross into the steeple and the entire 38 eight candle-power lamps changed and the belts replaced in less than a half hour."

A NEW IDEA IN CARNIVAL ILLUMINATION, by William S. Wallace; *Selling Electricity*, March.

An illustrated article describing the special illumination used during the recent industrial exposition of the Rochester Chamber of Commerce.

STREET ILLUMINATION AS AN ADVERTISEMENT; *Municipal Journal and Engineer*, March 9.

The article describes and illustrates a number of typical decorative street lighting systems in various cities, giving details as to cost, to maintenance and installation.

MODERN HOUSE LIGHTING WITH LOW VOLTAGE, by E. B. Walker; *Canadian Electrical News*, March.

This article gives detailed directions for the use of low voltage tungsten lamps in connection with special transformers. It treats the subject in a plain but comprehensive manner.

STUDIES IN LUMINESCENCE: THE DISTRIBUTION OF ENERGY IN THE FLUORESCENT SPECTRUM, by E. L. Nichols and Ernest Merritt; *Physical Review*, March.

A highly technical article of interest only to scientific investigators.

SELECTIVE RADIATION FROM VARIOUS SOLIDS, by W. W. Coblentz; bulletin of the Bureau of Standards, February.

This is the second paper on this subject, and gives the results of experiments with a number of substances that have not before been investigated. In each case curves are given showing the spectra at different temperatures.

LUMINOSITY AND TEMPERATURE, by P. G. Nutting; bulletin of the Bureau of Standards, February.

The report of experiments to determine the direct relation between luminosity and temperature; highly technical.

THE LIGHTING OF TEXTILE MILLS, by W. C. Andrews, *Textile World Record*, March.

This is the first of two articles on the subject to appear in this magazine, and is devoted chiefly to the economical importance of the illumination problem in the textile industries.

PHYSIOLOGY OF VISION, by Dr. C. W. Talbot, *Optical Journal*, March 17.

A continuation of the serial articles by this writer. While the articles are written specially for optimetrists, they furnish an excellent text for illuminating engineers who wish to familiarize themselves with this subject.

Foreign Items

COMPILED BY J. S. DOW

ILLUMINATION AND PHOTOMETRY.

PROCEEDINGS OF THE ILLUMINATING ENGINEERING SOCIETY, LONDON (see *The Illuminating Engineer*, Lond., February and March, 1910; also referred to in a great number of technical papers in Great Britain, too numerous to state specifically).

Special interest attaches to the discussion on "THE NATURE AND CAUSES OF GLARE," which took place at the last two meetings of the society, and are reported as above. The views of a large number of authorities, both British and foreign, are given. One of the chief items discussed was the desirability of stating a definite limit to the intrinsic brilliancy of units to be used in interiors. Ultimately it was resolved to appoint an International Commission to deal with the matter.

Another important item has been the FIRST ANNIVERSARY DINNER of the society, which is fully reported in the March number of the *Illuminating Engineer*

(London). The dinner was attended by representatives of the Institutions of Gas and Electrical Engineers, the Royal Sanitary Institute, the Physiological Society and other learned bodies, the keynote of the speeches being "co-operation."

ON THE EXTINCTION OF COLOR BY REDUCING LUMINOSITY, by W. Abney (*Proc. Roy. Soc.*, Lond., 83, Feb. 10, 1910).

It is known that at extremely low illuminations the eye is no longer able to distinguish colors. The author gives some curves illustrating the degree to which different regions of the spectrum must be dimmed before disappearance of the color-sense takes place. He regards his results as justifying the well known "three sensation" theories of color-vision.

THE DISTRIBUTION OF ENERGY IN THE SPECTRA OF ILLUMINANTS, by Coblentz (*Illum. Eng.*, Lond., February, 1910).

Deals with some of the most recent aspects of radiation problems as affecting the production of light. The author, in this installment, deals with the so-called "Grey body."

BELEUCHTUNGSKUNST, by R. Bernoulli (*Z. f. B.*, Jan. 30, Feb. 10, 20).

The author discusses the illumination of the exteriors and interiors of buildings of special architectural distinction with a view to revealing their artstic merits. He also describes some old forms of lanterns for porch and stairway illumination, which formed the subject of much ornament in the past.

ON THE ILLUMINATING POWER OF GROUPS OF PINHOLE BURNERS, by R. G. Harris (*Proc. Roy. Soc.*, Edinburgh, 30, 1909-1910).

A rather academic treatise. The author gives curves illustrating the manner in which the illumination of such point-sources varies as their distance apart is increased.

THE INTERNATIONAL UNIT OF LIGHT, by B. Monasch (*G. W.*, Feb. 12; translation).

A reproduction, with comments, of recent German discussion on the international unit of light; the general view of German authorities still seems to be that while they recognize the ratios between the various units used, they consider the term "International" premature.

VERGLEICHSVERSUCHE UBER DIE SCHWANKUNGEN DES LICHTES VERSCHIEDENER BOGENLAMPEN, by E. Presser (*E. T. Z.*, Feb. 24).

An interesting illustration of the application of selenium cells to photometry. The author points out that, though such cells cannot be used for absolute measurements, owing to their uncertain behavior, they can be effectually used for studying the relative variations in one and the same light. He presents curves illustrating the fluctuations in light of various arc lamps, etc., obtained by this means.

ILLUMINATION: ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter (continued; *Illum. Eng.*, Lond., February, 1910).

In this installment the author gives an account of some researches on the height at which the illuminated surface of an illumination-photometer should be used for street lighting. He also refers to the need for very good contacts in battery connections, owing to the low voltage employed.

THE NEED FOR THE MEASUREMENT OF ILLUMINATION, DAYLIGHT AND ARTIFICIAL, by P. J. Waldram (paper read before the Society of Architects, London; *Illum. Eng.*, Lond., February).

The author lays special stress on the need for more exact study of daylight conditions, especially on the part of architects. He gives some account of the existing legislation, which he considers very incomplete.

Economy and Municipal Mismanagement (*J. G. L.*, Feb. 8).

Comments on the recent decisions of certain municipalities to use electricity for public lighting in preference to gas. It is contended that as the present arrangement is continually giving dissatisfaction a central body ought to be formed, capable of dealing authoritatively with the subject. It is suggested that the Treasury, the Local Government Board, or the Board of Trade should appoint a commission to inquire into the matter.

Die Beleuchtungswesen in Belgien (*Z. f. B.*, Feb. 20).

ELECTRIC LIGHTING.

Electric Arc Lamps, by A. Angold (*Elec. Engineering*, Feb. 24).

This is a paper recently read before the Association of Engineers in Charge (London). The author summarizes the most recent developments in flame arc lamps and the various problems which have to be met. He makes special mention of the magazine arc lamp. He also enters into a comparison of the costs of upkeep of arc lamps and high candle-power tungsten lamps. Finally, he refers to the need of hanging lamps high up, so as to avoid glare, and points out that the flame arc possesses a smaller intrinsic brilliancy than the pure carbon type.

A New Arc Lamp, by P. A. Mossay (*Electrician*, Feb. 11, 1910).

The author describes the "Timar-Dreger" lamp, recently dealt with very fully by Wedding (see previous review). One essential peculiarity of this lamp is that the carbons are parallel and horizontal.

Die Herstellung der Metallfaden (*Z. f. B.*, Jan. 30).

The "Z" Metallic Filament Patant (*Elec. Engineering*, Feb. 24).

GAS, OIL, ACETYLENE LIGHTING, ETC.

Acetylen im Konkurrenzkampfe mit Gas, by Busch (*Z. f. B.*, Jan. 30).

Acetylene as an Aid to Science, by J. W. Gatehouse (*Acetylene*, February).

The author dwells mainly on the value of the spectrum of the acetylene flame for revealing colors in scientific work with the microscope, etc.

Fortschritte auf dem Gebiete der Invertbeleuchtung, by D. Witt (*J. F. G.*, Jan. 29).

General summary of recent German improvements in gas lighting, especially in connection with the use of inverted mantles. An efficiency of 0.45 litres per H. K. has now been obtained. Mantles for street lighting in Berlin last about 200 hours. An account is given of the recently introduced system of raising and lowering gas lamps, and also of slinging such lamps on wires stretched across the street. One interesting case of practical lighting mentioned is that of the illumination of school rooms. The semi-indirect system is here preferred. Reference is made, however, to the system of placing incandescent gas lamps, well screened, between the pillars on one side of the room, so that the light comes in exactly the same direction as does the daylight.

The Cost of Gas and Electric Lighting (*J. G. L.*, Feb. 8; *G. W.*, Feb. 5).

Acetylen und Luftgas (*J. f. G.*, Feb. 5).

Contractions used:
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. *Illuminating Engineer (London).*
J. G. L. *Journal of Gaslighting.*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The
Illuminating Engineer

Vol. V MAY, 1910 No. 3

ENTHUSIASM

Every work performed by man has two results—one upon the man who performs it and one upon those for whom it is performed. The first of these is often overlooked, but is of at least equal importance with the second. "Man does not live by bread alone," nor can he live by the material results of his labor. Unless the performance of his daily task brings to him some positive subjective good, and assists in his growth, a man cannot properly be said to live; he only vegetates, or exists.

Some educator once said that "digging ditch would be as valuable as studying Greek, if done in the same spirit." "The spirit giveth life"; it is the enthusiastic interest with which we perform the task that quickens the pulse, stirs the intellect, and satisfies the whole being. This can only result when there is a consciousness that the task performed is useful, that it will directly benefit others.

The greater the beneficence of the results of our labor, the greater the enthusiasm with which we can take up the task. Herein lies one of the greatest attractions in the work of literally causing more light to shine: it is a labor in which the results are not only great, but have a distinctly uplifting effect upon man, as well as adding merely to his "creature comforts."

He who is engaged in any one of the numerous branches of the lighting industry, whether it be persuading others to a better and larger use of some illuminant, or promoting the more decorative and rational utilization of light, or in the discovery and improvement of means of producing this greatest of the boons of science, may work with inspiring thought that the general good is being subserved.

Every worker in the field of light has the greatest possible incentive to enthusiasm; and who shall say that a very large measure of this enthusiasm is not realized in the actual life of those engaged in the labor?

LET THERE BE MORE LIGHT.

E. L. Elliott.

FIG. I.—BROADWAY, GARY, IND.

Decorative Lighting in Gary, Ind.

Gary is the latest example of the American practice of building cities to order. When the officials of the United States Steel Corporation, whose business operations excel in magnitude the entire disbursements of many of the civilized countries of the world, looked about for a spot on which to re-locate the center of the largest single industry in this country, they decided upon a spot which has few attractions to a casual observer. The sand dunes of northern Indiana are not the place that a lover of nature would select as a home; but Gary is preeminently a commercial city, and the conditions determining the choice of location had little to do with picturesque scenery. But as the beautiful city of Paris grew upon the mud banks of the Seine, and Chicago sits on piles driven into the bogs on the shores of Lake Michigan, it is possible for Gary to make up in municipal beauty what its situation lacks in natural attractions. Although but a few years old, a good beginning has already been made toward this end.

Fig. 1 is a day view of Gary's Broadway, which has the advantage over its namesake in New York by being broad in fact as well as in name. As is natural where land is plentiful, Gary has thus far grown outward rather than upward. The excellent pavement, the absence of unsightly poles along the curb, and the very neat and substantial manner in which the overhead trolley wires are supported are evidences of care and pride in the building of this remarkably young city.

The lighting system on this, the principal thoroughfare, consists of 34 posts supporting five lamps each, and 104 posts with three lamps each, the former being used at street corners, as shown in Fig. 2. The center lamp on the five-light posts is a 100-watt tungsten with a 12-in. alabaster globe; the four pendant lamps

are 60-watt series tungsten, with 10-in. alabaster globes. The same relative sizes are used on the three-light posts. The current is supplied through lead covered cables run in conduit along the edge of the sidewalk the entire length of the street. Each post is supplied with an automatic cut-out. The current is supplied from two generators through constant current transformers which maintain the current of 6.6 amperes, the voltage on the circuit being 2200. These circuits are controlled from the sub-station, and are switched on every night at dusk and shut off at 11 p.m. All lamps are provided with cut-out sockets, so that in case one lamp goes out the balance of the lamps in the series are not affected. The installation has given very little trouble, although the upright lamps on top of the posts have shown some tendency to breakage of filament.

Fig. 3 is a night view of Broadway with the installation in use, showing the excellent distribution of illumination, as well as a highly decorative appearance.

From the illuminating engineering standpoint this installation must meet with general approval. The lamps in a pendant position are well placed for producing the desired illumination of the pavements, while the upright lamp adds a distinctly decorative feature while contributing materially to the general purpose. The design of the posts, while not elaborate, is well proportioned and in keeping with the character of the buildings. It is neither cheap-looking nor extravagant.

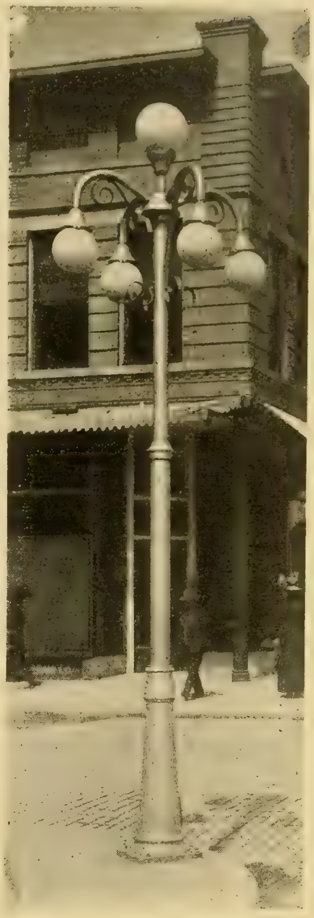


FIG. 2.—TYPE OF CORNER LAMP STANDARD.

FIG. 3.—GARY'S "GREAT WHITE WAY."

Light and the Eye—An Experiment

By Albert Jackson Marshall.

The writer, who for some time past has given considerable thought and study to the subject of natural and artificial illumination of school rooms, became impressed with the idea that, while it seemingly was possible to provide what might be termed adequate illumination in a classroom, such results were of comparatively little value unless the students were studying at home under the proper conditions and using their eyes generally in an intelligent manner. These thoughts led to an experiment which is set forth here for what it may be worth.

A student, male, age 15, of general good physical condition, bright and of reasonably even temperament, was persuaded to place himself absolutely under the guidance of the writer for a period of two weeks for the purpose of endeavoring to ascertain what benefits, if any, could be derived from the careful use of his eyes outside of school as well as during school hours. This lad, about 18 months prior to this test, had been examined by an oculist and was fitted with glasses, which he was compelled to use while reading and studying; the usual penalty for not wearing same being apparent fatigue to the brain and strain and pain through the eyeballs, ofttimes giving rise to headache.

The writer first obtained from the authorities of the school that the boy attended the " lessons " which he would be called upon to study during the two weeks of experiment. He then, in so far as it was possible, arranged to have these " lessons " taken from their regular text-books, which were printed in the usual manner—black ink on white paper, and ofttimes on highly glazed paper at that—to a light India or amber tinted mat surfaced paper, same being executed by means of a typewriter using " elite " type.

The room, size 15 x 15 ft. and 9 ft. high, regularly used by the boy at home when studying, was lighted by a central (typical) combination gas and electric fixture, equipped with plain glass shades and two 50-watt clear Gem lamps placed at an angle of about 45 degrees, providing a general illumination, so that it appeared that all parts of the room were about equally illuminated. The ceiling was of white plaster finish, while the walls were covered with a dark red paper, the surface of which was fairly highly finished, thus making it possible to obtain regular reflection, but not to a marked degree. The furniture was of mahogany, upholstered in dark and somewhat highly glazed leather. The draperies were, for the most part, dark in tone, excepting the lace curtains, which were white. The chairs were so placed and usually used so that while he was not directly facing the light, the rays did not come from the rear and ofttimes gave rise to regular and somewhat too brilliant illumination. As the room is used for general living purposes, absolute silence was rare, although " talk " was reduced during the study period as much as possible. Everything considered, this room was not altogether desirable, so another room was secured for the purpose of study.

The room secured was of the same dimensions as the room previously described. The ceiling and about 15 in. of the upper parts of the sides of the room were of a white plaster finish. The walls were covered with a " smoked " gold paper with an indefinite, large conventional design. The surface of this paper was less highly finished than that used in the other room. The draperies consisted of a pair of ecru lace curtains and two pairs of dull dark green velour curtains, while the floor was largely covered by a rug, the colors of which were of a low order and bearing a very indefinite design. The small amount of woodwork in the room was of a dull finish, ivory tone, while the woodwork of the furniture was mahogany, with dull, dark-green velour upholstery.

The room selected was equipped with a stereotype form of combination chandelier, which was not used during the experiment—a portable lamp using a 60-watt clear tungsten lamp, surrounded in its lower part by a diffusing and redirecting prismatic hemisphere and in the upper part by a leaded glass dome of cathedral

roughed amber glass. This illuminant was further equipped with a dimming device, so that any desired intensity of illumination could be readily obtained. This illuminant was placed on a table of ordinary height and arranged in such a manner that the light rays fell on a book held in the student's hand over his left shoulder —the illuminant not being in the direct line of vision—thus permitting the eye to adjust itself solely to the intensity and quality of illumination on the observed book or paper.

Beginning with a Sunday evening the experiment was started by having the boy begin the study of his first "lesson." After he had read a portion of his lesson for a period of ten minutes he was caused to look from the printed page off into the room, which was illuminated solely by the portable lamp to a very low order for a minute or so, during which time he slowly looked from object to object, thus, to a measure, exercising the muscles of his eyes by the different focuses required. This method of procedure, namely ten minutes' study and a couple of minutes rest, was continued throughout a period of an hour and a half, during which time several subjects were studied.

The following morning, Monday, the boy was seated in a classroom, the ceiling and sidewalls of which, not taken up with windows and blackboards, were white, with desks of dull oak finish. His position in the classroom was such as to permit the light to come over his left shoulder; also regular reflection from the somewhat polished surface of the blackboards, as well as from the glass partitions, which ofttimes is evidenced, was eliminated. The boy was permitted to use the same nature of paper that he was using at home—namely, light amber tinted mat-surfaced paper —*regular school books during the test not being used.* During the time the student spent in the school room he was caused to use his eyes so that strains from long application would not be produced. During the recess he was forbidden to use his eyes for distinguishing small detail, and caused to enter into the spirit of play with the rest of the children and give his eyes a complete change. After school hours the same conditions were imposed upon him. After the first three or four days of this experiment the boy was almost totally free from "headaches" and "eye tire," and by the end of the week, to use his own expression, he "forgot he had eyes."

Beginning with Sunday night of the second week the first ten minutes' study period the boy used his glasses, and during the intermission of a couple of minutes took them off. On Monday evening five minutes of each alternative study period was made without the aid of glasses, while during the intervening study periods glasses were used; glasses during rest period were dispensed with. Tuesday evening glasses were used only during every other ten minutes' study period. Wednesday evening three-quarters of actual study was done without glasses, and on Thursday evening no glasses were used. Up to this period the boy had been using his glasses during study in the school room, removing same during recitation. On Friday morning glasses were dispensed with during school hours. While my observations ended with the second week, yet the child's parents have reported to me, from time to time, over a period of four or five months, during which he has not worn glasses, the steady improvement effected in the boy's eyes.

While it may be unwise to draw final conclusions from an experiment conducted with but one person, under but one set of conditions and conducted in a more or less rapid manner, yet the results obtained would seem to warrant more intelligent thought being given to the use of students' eyes not only in the school room but at their home as well, and not simply satisfying ourselves by trying to provide what we may feel to be sufficient illumination in the classroom—and spectacles for the student.

I have been thoroughly convinced for some time that while there are many conditions in the school room requiring our attention, such as the natural and artificial illumination, the color and character of such surfaces as the walls, ceilings, blackboards, desks, etc., as well as the character of paper and printing used, to say nothing of such important things as ventilation, etc., yet our investigations must be carried beyond the school room to the home and the habits of the students, if we expect to obtain anywhere near ideal results. I

therefore take this opportunity of suggesting that teachers in our public schools be acquainted in as much detail as possible with this most important matter, and have them assist in educating school children along proper lines. To my mind the study of this subject is of paramount importance. With all due respect to school teachers in the country, I have found their ignorance of this matter colossal. Let us provide proper conditions in the school room, but also let us educate those who use it to know how best results may be obtained in their outside life as well.

Railroad Illuminating Engineering—Track Scale Lighting

By Harold Kirschberg.

Of the many special problems of illumination presented on a railroad, none perhaps is of more importance from a railroad viewpoint or is capable of more solutions than that of track scale lighting. A track scale, as shown on the accompanying sketch, is a scale, from 37 ft. to 83 ft. in length, built on a concrete foundation, set in the line of track and connected by means of levers to the scale beam in the adjoining scale house. It is used to weigh all freight passing over the road, a large percentage of which is weighed at night, thus necessitating a good lighting system in and around the scale house. Inasmuch as a large proportion of railroad revenue depends on freight haulage capacity, and for the reasons that better light around the scales permits a better movement of cars over the scale and through receiving and classification yards, so increasing that capacity, it is evident that the successful solution of this problem is greatly to be desired.

The purpose of this exposition of the subject is not so much to offer a solution as it is to present the conditions to be met, leaving the suggestion of type, location and auxiliary fittings of lamps to the individual. It will, therefore, be necessary to explain, as briefly as possible, the operation of weighing, with which explanation the important points needing light will suggest themselves.

The train of cars to be weighed is pushed from the receiving yard to the hump, where each car is cut from the train and allowed to float by gravity down the 2 per cent. grade to and over the scale, thence down the 1.4 per cent. clearance grade to the classification yard to be made up into another train. As the car passes over the scale at a speed of about 2.5 miles per hour the weighing is done. In addition to the weighing, the number and light weight of the car is read from either the ends or side of the car, and a record of same made on the manifests in the pos-

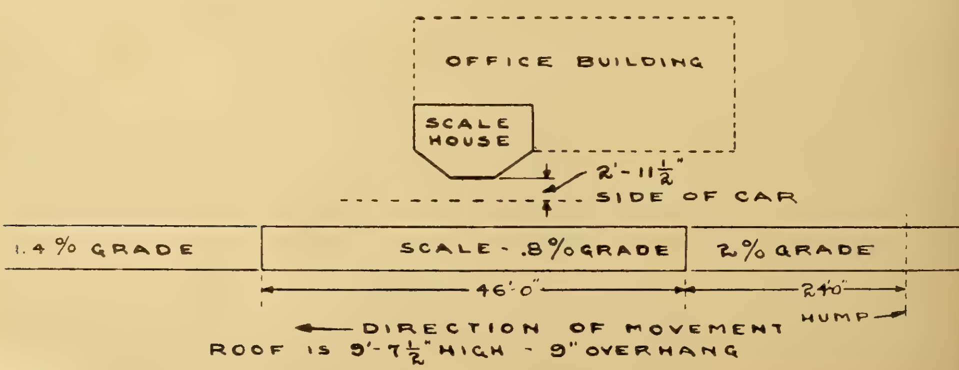


FIG. I.—TYPICAL TRACK SCALE LAYOUT.

session of the weighmaster. The entire operation takes from eight to twelve seconds. It is also necessary to see under the car to a certain extent, in order to determine whether the car is entirely on or off the scale. Each car is in charge of a rider, who keeps his position on the car until it has passed over the scale. The conditions to be met in the lighting of the location are, therefore, as follows:

1. Sufficient illumination in the scale house, with special attention to the scale beam in the bay window, to permit rapid and accurate weighing. At the same time the lamps should be so placed and shielded that none is in the field of vision either from the inside or outside of the scale house, and that no reflection of the lamps is seen in the windows, thus making it very difficult to see numbers on the cars outside. If interior lamps are visible from the outside, the glare may be sufficient to prevent good vision around the hump and clearance grades, so resulting in possible accident to riders and car cutters.

2. Sufficient illumination outside the scale house to permit those inside and outside to perform the following duties:

Safe cutting of cars at the hump.

Location of car at every point in its movement.

Clear sight of movement of every wheel on to the scale.

Reading of light weights and numbers on ends of approaching cars.

Reading of same on side of car on scale. For this work a clearance of 2 ft. 11½ in. is all that is allowed.

Reading of same on receding end of car if not procured during either of the two aforementioned intervals.

Movement of wheels off the scale.

Clear sight of movement of car down the clearance grade in order to safely pass the next car over the scale.

Location of position of car on the clearance grade in order not to bump cars too hard when making up drafts of cars to go down the classification yard.

It is evident that the weighmaster must look from a well lighted room into an illuminated open space with a dark background in order to work; also that the riders are continually moving from a well lighted zone into one with a very low intensity of illumination. Glare in such cases is productive of not only danger to individuals, but also possible damage to equipment and loss of time and money. It would assuredly not be correct to use the series yard lighting system for lighting the exterior, for the reason that light is needed at the scale some time before the yard lighting is necessary. All lamps should, therefore, be on a separate control. With the low height of roof, the small roof overhang, and the narrow space between the side of the car and the scale house window, the problem of placing units of large enough capacity and sufficiently low intrinsic brilliancy to do the work is not a very simple proposition. The outside lamps should by no means be visible to the weighmaster.

In locations where an office building, as shown in dotted lines on the sketch, is in use in addition to the scale house the entire front of the building is available for the placing of lamps, thus offering another solution to the problem. The only standard portion of the building, however, is the scale house bay window and its scale beam. Within the scale house proper may be placed one or more desks, filing cabinets, letter press, wash basin and other furniture and fixtures found in the modern office. An illumination scheme to provide for this additional portion of the office, however, must be somewhat different from the usual office lighting layout to obviate the possibility of imperfect vision both inside and outside the scale house.

There is, no doubt, a number of methods of obtaining the desired result, but inasmuch as an engineer is one who is supposed to do for one dollar what any one else can do for two dollars, it is evident that the cheapest and at the same time equally reliable and successful solution is the only one deserving of the appellation of illuminating engineering.

The location of neighboring lighting units, such as may be used for yard or office lighting, will, of course, affect the efficiency of the scale lighting installation. Each case, therefore, contains some features not found in other cases, in which event a study of local conditions for each scale is necessary. Track scales, often being located at points somewhat distant from power plants, the electrical condi-

tions usually furnish an alternating current, in which case the choice of efficient lighting units and desired distribution of light is narrowed still further than other conditions alone would cause them to be.

It is apparent, therefore, that, considering all the conditions to be met and while attempting to light the scale and its surroundings cheaply and efficiently, a study and solution of the problem of track scale lighting draws upon the illuminating engineer not only for a through knowledge of illuminants and their particular qualities, but also for a fair amount of ingenuity in their use to obtain the best results. Naturally, with so many variations in scale length, and the form of energy available, surroundings, etc., it is very difficult and well nigh impossible to lay out a standard scheme for all scales. Were such possible, the solution of the problem would be merely the question of several trials. The individuality of each case, however, is so strong that experienced judgment, combined with knowledge, is the only basis upon which to work.

Notes on Opaque Reflectors

By C. O. Baker.

At the last annual convention of the Illuminating Engineering Society Mr. L. B. Marks presented a paper, in the course of which he argued convincingly in favor of general illumination for industrial plants. With the recommendation of so eminent an authority this practice has been receiving greater attention than heretofore.

The filament of an incandescent lamp is so constructed as to give a maximum of candle power in a horizontal direction, with a little less than 50 per cent. flux radiating above the horizontal. Therefore, as any diversion of the light by means of a reflector is accompanied by an absorption varying with the nature of the reflecting surface, obviously where direct radiation can be utilized the unit with a maximum of radiated light must prove the most efficient.

The accompanying illustrations (Figs. 1, 2, 3) show three types of reflectors, two of which illustrate the principle just enunciated, while the third is designed especially with a view to a maximum of efficiency in localized lighting. In all three types provision is made for the attachment of holders which will bring the center of the light source in the proper position with reference to the reflecting surface to produce a maximum of illumination within the predetermined zone.

The first type consists of flat fluted reflectors (designated group "F"); the second, shallow dome reflectors (group "D"); the third, reflectors of a true parabolic form (group "P").

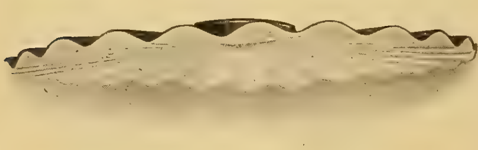


FIG. 1.—GROUP "F."

FIG. 2.—GROUP "D."

FIG. 3.—GROUP "P."

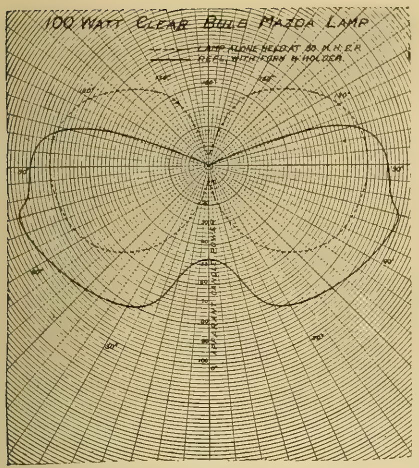


FIG. 4.—TYPICAL PHOTOMETRIC DISTRIBUTION CURVE FROM GROUP "F" REFLECTORS.

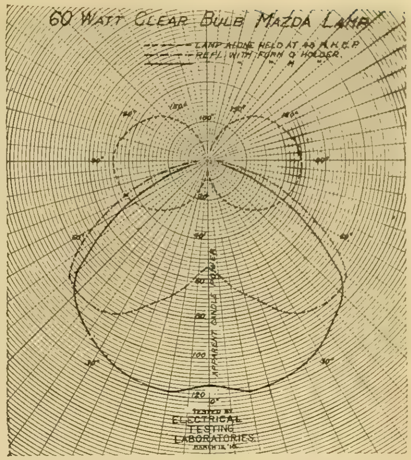


FIG. 6.—TYPICAL PHOTOMETRIC DISTRIBUTION CURVE FROM GROUP "P" REFLECTORS.

Certain classes of industrial plants, operated by belt-driven machinery (with shafting, belting and pulleys near the ceiling) require a small amount of light radiating above the horizontal for adjustment, oiling and repair. In this class of work group "F" reflectors are exceptionally efficient.

Other plants requiring general illumination, but no light above the line of the horizontal, make special use of group "D" reflectors.

In determining the value of such reflectors for purposes of general illumination careful attention must be given the position of the center of the light-source and the use of reflectors of a diameter sufficient to intercept the valuable upward rays. A series of experiments conducted for this purpose resulted in the plotting of curves, one of which is given herewith, showing the intensity at an angle of 15 degrees below the horizontal, with a 16-in. group "F" reflector placed at various heights above the center of the filament in a 100-watt "Mazda" lamp. This curve serves to show that if a maximum intensity at 15 degrees below the horizontal is the most serviceable angle for general illumination—and it usually is—the reflecting surface would preferably be placed 2⅝ in. above the center of the filament. Other experiments have determined that, while the greater the diameter the better, a 14-in. flat reflector is amply large for a 60-watt lamp and a 16-in. for a 100-watt lamp, while a 20-in. reflector at least should be used with a 250-watt lamp, having in mind always the position of the center of the light-source as recommended above.

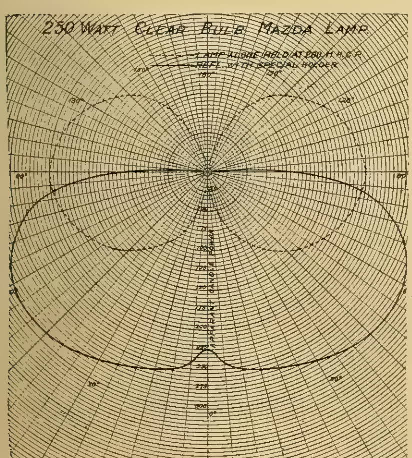


FIG. 5.—TYPICAL PHOTOMETRIC DISTRIBUTION CURVE FROM GROUP "D" REFLECTORS.

A similar condition exists with regard to the position of the center of the light-source in group "D," the inner part of whose reflecting surface begins at about the same point with the outer circumference, 5 degrees below the horizontal, by which a curve is produced showing a

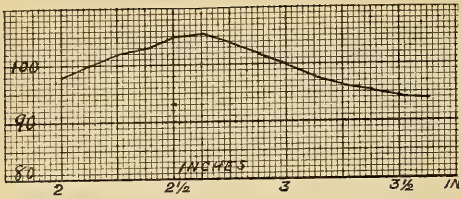


FIG. 7.—C. P. AT 15° BELOW HORIZONTAL, WITH 16 IN. GROUP "F" REFLECTOR AT VARIOUS HEIGHTS ABOVE TUNGSTEN LAMP HELD AT 80 M. H. C.

maximum candle power at 60 degrees. In this type a 14-in. reflector is recommended for 60-watt lamps, an 18-in. reflector for 100 and 250-watt lamps (the shape of the curve varying with the height of the reflector above the lamp), and a 20-in. reflector for 500-watt lamps.

In regard to group "P" reflectors, it is generally understood that parabolic reflectors have the property of projecting light in parallel rays, but the fact is seldom recognized that there is a certain fixed relation between the focusing point and the reflecting surface, and many reflectors on the market called parabolic are no more so than the old-fashioned tin cone shades, except that, being drawn from steel, aluminum or brass, the upper part of their straight sides may be slightly rounded near the apex.

Reflectors in group "P" are truly parabolic in form, and have collars to which standard form "H" holders may be attached, bringing the center of the filament in its proper position. The diameter, too, of the reflectors for the various sizes of lamps is such that the light is reflected downward tangent to the bulb, with an efficiency (as shown in the accompanying curve) greater than is claimed by any other opaque reflector offered on the general market which gives a corresponding ratio of total flux within similar zones.

It is furthermore an interesting fact to note from this curve that, by using a form "O" holder with this reflector, an extensive light distribution is effected, with an exceptional efficiency for this unit also.

As to the finish of these reflectors, groups "F" and "D," being generally used under conditions where dust and grime freely collect on any surface, are made of porcelain enameled steel, with a white reflecting surface. Group "P" reflectors are made in porcelain enamel on steel, also especially for use in machine shops where dirt and grease render their frequent cleaning necessary; for breweries, abattoirs, ice houses, etc., where there is an abnormal moisture in the atmosphere; for dye houses, bleacheries, paper mills, chemical works, etc., where acid fumes rapidly disintegrate painted reflectors; or where reflectors are used for out of doors in exposed locations.

For use in textile mills, shoe shops, over work benches and similar places requiring localized lighting under less severe conditions than noted above, group "P" reflectors are furnished with paint enamel outside and mat aluminum reflecting surface.

In the matter of the installation of these types of reflectors, it may be said that where opaque reflectors have a distinct field of usefulness, just as have prismatic and opal glass reflectors, like these latter, improper use can frequently be made of them to their disadvantage. While, of course, the manufacturers of either will not hesitate to recommend them for all purposes, the exercise of good judgment would not suggest the installation of opaque reflectors in stores, offices, halls, churches, etc., where there is a distinct decorative value attaching to the small amount of light passing through a prismatic or semi-opaque reflector. On the other hand, in mill and factory work, where the light radiating upward through the reflector is wasted, this amount of light, small as it is, can be diverted by an efficient opaque reflector to same highly useful direction.

FIG. I.—ADJUSTABLE STANDARDS, PIAZZA DU MARTIRI, NAPLES.

Brieflet on Municipal Regulation of Private Lighting Standards

By L. Lodian.

Various of the continental cities have their municipal ordinances regulating the character, design, material height *et al.* of public, and sometimes even private (if exposed on the public way), lighting fixtures, pedestals, etc.

Here in America such regulations concerning lighting fixtures outside houses would be regarded as interfering with the liberty of the citizen. Whether a *laisser-faire* policy is best is a matter of opinion. Take, for instance, the splendid vista of the Avenue de l'Opéra, Paris. Every private lighting fixture thereon outside a store or house must be in harmony with the regulation municipal lighting standards—just as every house must follow an approved design, with what result, architecturally, the visitor well knows—making the French capital a city of magnificent vistas in avenues and rues.

It is difficult to say here to draw the line at "municipal regulation in everything." In some cases it might make for beauty, but certainly stultify variety and effort. In some things, municipal control might advantageously be introduced in more ways than in lighting standards. Thus, look at the backing of wagons in our cities—and especially Manhattan—right on to the sidewalks in many of our busiest streets, forcing walkers to dodge or turn into the street ever and anon, and at the risk of getting their toes crushed—or something worse—by other passing vehicular traffic. The streets about the

ferries are notorious for this. Surely there is not a reader of these lines but who has experienced this melancholy proceeding.

Now, such practices would never be allowed in leading continental cities—not even in Russian cities like Mockba and Petersburg—except during the hours when the busy streets were almost free of pedestrian traffic—as between 8 P. M. and 8 A. M. If such a regulation were enforced in certain Manhattan sections it would greatly relieve over-congestion of traffic during the daytime.

Much might be written on the subject pro and con of municipal regulation of private lighting fixtures on public ways. But what profiteth it all—for the present? We may get to that some day—just as some European cities have had to take in hand the abuse of public advertising boards, signs, posters, etc. "Let us have light—and more light!" is the slogan of one lighting specialist, but he ever means that that lighting shall conform to modern ideas of propriety, harmony and convenience.

A couple of views herewith typify municipally regulated lighting standards in two widely separated Italian cities—Milano in the north and Napoli in the south. They are fairly representative of what lighting standards should be like as befitting plazas possessing national monuments, which alone are sufficient to make the views fine ones. It is doubtful if they could be much improved upon—if at all.

In the Milano view it will be remarked the standard is of metal throughout. The site is in one of the most beautiful parts of the city, close to the duomo (cathedral), with its forest of statue-crowned spires. When visiting several years ago the central station in proximity thereto, the writer remarked how the walls of the dynamo room were covered with beautiful old frescos, the vivid coloring of some of which appeared as if the work of but a few years ago. It transpired that this dynamo shed was formerly an ancient convent, and the frescos were the pious work of its inmates of centuries ago. Curious mingling of the new and the old! Here were ceaseless modern dynamos, oil-bespattering, the staid, ancient frescos!

The Napoli photograph shows wood standards for the adjustable arc lights. In different parts of the city, the standards are variously of wood and metal, according to the tax-paying ratio of the quarter. In the scene depicted in the illustration this is not one of the more important tax-paying *parokias,* so has to be content with wood posts. Thus do municipalities arrange lighting standards according to the taxable qualifications.

FIG. 2.—ARC LIGHTING STANDARD. PLAZA DE LA SKALA, MILAN. NOTE THE SMALLER TOPMAST GLOBE.

New Photometric Processes

BY AN ENGLISH CORRESPONDENT.

An interesting addition to photometric processes has recently been made by E. Presser, who points out the value of the Selenium cell as a means of studying sudden fluctuations in the light of a source (*E. T. Z.*, Feb. 24, 1910). It is rather curious to reflect that, although much is said as to the "steadiness" of this or the other source of light, there have been few scientific attempts to reproduce such variations as occur in arc lamps, etc.

The study of such rapid phenomena cannot, of course, very easily be carried out by purely photometric methods of the ordinary kind. By the time one's photometer was set to take a reading the conditions would have changed, so that it is only comparatively slow changing phenomena that can be examined in this way. Some purely physical means is desirable. Presser's method is very simple. He merely allows the light from the source to be examined to fall upon a special selenium cell. This is placed in series, with a battery and a galvanometer, the needle of which can record its movements on a traveling drum in the manner common to recording instruments. Any fluctuation in the light gives rise to a corresponding fluctuation in the resistance of the cell, and the needle of the instrument records this change by a "kink" in the curve.

A selenium cell cannot, apparently, at present be successfully used for *absolute* measurements of light on account of its uncertain behavior. For example, the sensitiveness of such cells is constantly changing from day to day. The actual resistance of a cell depends to a great extent on its temperature and the E. M. F. applied to it, and the inertia of the apparatus has to be guarded against. But a selenium cell can, the author suggests, be used to record the fluctuations, within a comparatively short time, of one and the same source of light. In support of his method Presser exhibits curves, showing the behavior of glow lamps and various types of arc lamps, obtained in this way.

It is interesting to note in passing that this is not the first time that selenium has been put to this use; it seems to have been used, for instance, to obtain a record of the gradually changing light during a solar eclipse as recently observed by a German scientific expedition. It has even been suggested that such cells, placed in schoolrooms, might be used to record the variations in daylight illumination enjoyed by pupils from day to day. In these cases also it is only relative measurements of the same kind of light that are required, though they would presumably be spread out over longer periods of time. It is, of course, always conceivable that a slow and gradual change in the condition of the cell might make the later measurements not truly comparable with the earlier ones when this is the case. Presser points out that in the case of his experiments no great error was to be feared from this possibility. He also remarks that it is very important to secure a cell with very low inertia in order that it may react quickly to sudden changes in light. This is provided for by using cells with an extremely thin coating of selenium.

It is interesting in this connection to recall some other experiments in a somewhat similar direction, namely those of W. Voege * in 1908. This observer also obtained comparative measurements of the same source of light, but he employed a thermopile, the face of which was covered by a special colored glass screen intended to cut off as far as possible the heat-rays, which form so large a portion of the energy radiated by all incandescent sources. This thermopile was exposed to the lamp to be tested and the variations in the current generated by the pile owing to fluctuations in the light of the source recorded on a moving drum in the same manner as described above. The apparatus thus served to compare the steadiness of different sources of light. But the author extended its use still further and was able to obtain polar curves of light distribution

* *Illuminating Engineer*, Lond., Vol. I., 1908, p. 239.

which he stated to closely resemble those obtained by purely photometric methods. By an ingenious contrivance he even succeeded in tracing out such curves automatically.

While, therefore, any purely physical effect of light must be used with caution for photometric purposes, it is quite possible that cases may be found in which such methods are admissible and convenient for purely relative measurements, and it will be interesting to watch how far they are taken up in the next few years. The possibility of such methods being successfully used to simplify the at present very tedious method of obtaining polar curves of light distribution also seems well worth bearing in mind.

Suggestions for Records and a System for Compiling Illumination Data

By Norman Macbeth.

The writer early experienced considerable difficulty in getting work done along approved lines in eliminating guesswork and the "I hope it will do" methods. The older process with cosine cubed tables, pencil, paper and drafting-board prohibited the proper attention to detailed calculations because of the expense in time and "midnight oil" necessary.

Three or four hours' work for results which may now be secured in as many minutes was a considerable handicap when this time had to be included in the regular day's work, and was somewhat of a burden when you had to show a profit on a fee quoted in competition with that kind of engineering, of which a considerable amount still exists—subsidized—and as free apparently to your client as the air you breathe.

A simple system of calculation and record was necessary. Every calculation made must be recorded in such a manner as to avoid duplication and be readily accessible. Securing photometric information from many sources—laboratory reports, sheets issued by manufacturers, articles in technical publications, even advertising columns of many of the gas and electric journals, represent a diversity of sources which it was early found almost impossible, or at least inadvisable, to properly index and file without a considerable loss of time or a prohibitive amount of work when you came to look for a combination having the distribution and size to meet a particular situation.

The writer has finally worked out the system herein described and illustrated, which seems to afford the maximum of convenience with the minimum of attention.

For the filing of illumination data regarding the various sources, curves, conditions, etc., a standard loose leaf four-post binder, 5 x 8 x 2½ in., is used, with ten special printed forms of flux-polar and illumination data sheets, Fig. 1, together with other plain ruled forms for noting plan and fixture design files. This binder will contain records of 450-light distribution reports, with 150 live flux-polar diagrams; 150 sheets comprising 1500 columns for noting the illumination values on horizontal or normal planes for the various heights and distances calculated from the 150 approved light distribution curves, and an elaborate index and cross index of over 50 pages if required.

The A to Z index, besides being used for cross indexing, also carries information relating to lamp life conditions, maintenance or any general information which may be required in the course of everyday work.

Figs. 2 and 3 may give an idea of the completeness, compactness and get-at ability of this system of records. All the vital information contained in fourteen reports and clippings, similar to those shown in Fig. 2, may be recorded as shown, Fig. 3, on the two pages, 24 and 87, with the three correspondingly paged sheets giving the data and special conditions of the tests. Pages 24 were special tests of experimental reflectors, and required a third plain sheet for the tabulation of the exceptions. These sheets also provide for the numbers of the

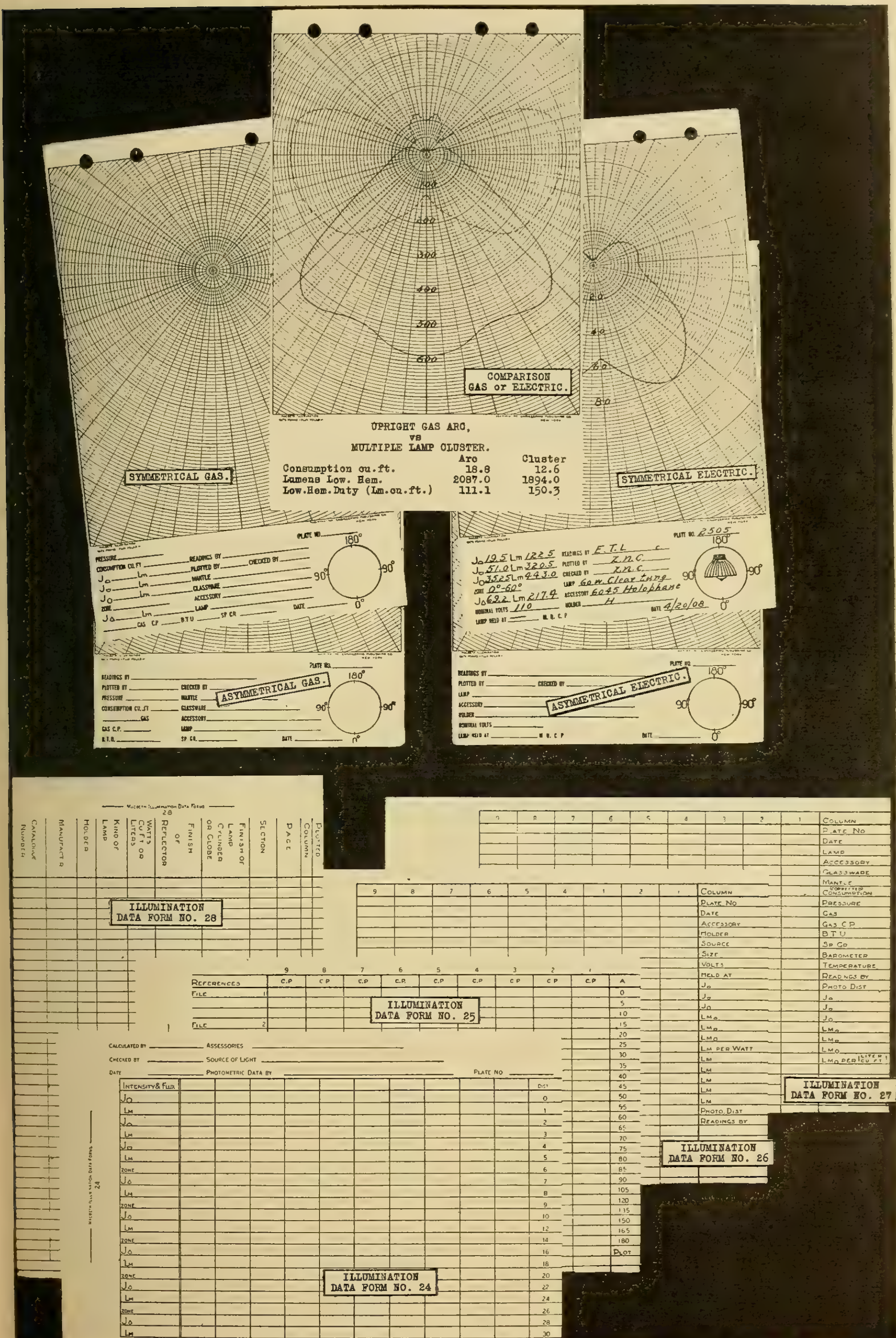


FIG. I.—FLUX-POLAR SHEETS AND DATA FORMS.

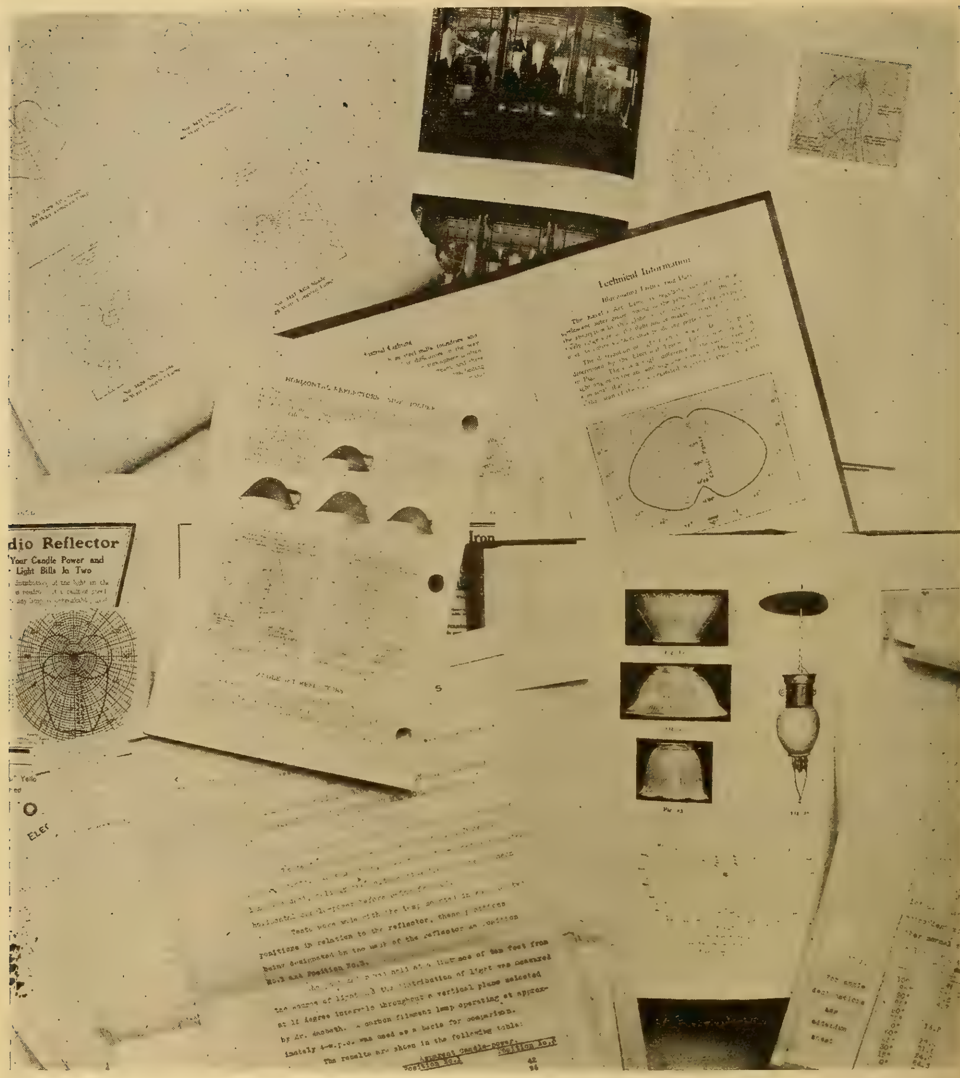


FIG. 2.—VARIOUS SOURCES FOR ILLUMINATION DATA.

document file envelopes or other folders where the original reports, clippings or references are for the meantime buried, but may readily be referred to if required to check an apparent inconsistency which, it is assumed, may be due to an error in transcribing.

This data book is divided into four main sections:

E, or electric sources; G, or gas sources; the numerically classified illumination and corresponding flux-polar sheets, and the index.

Section E contains the electric record forms, No. 25 for tabulating the light intensity values for the various sources at the angles investigated photmetrically and No. 26 for noting the conditions under which the tests were made. These two forms carry the same page number, so that the information covering the test conditions will always be with the corresponding sheet on which the photometric results are given. If a set of tests should be noted which are irregular, under special conditions or with special apparatus, a plain

sheet with the same page number may accompany forms Nos. 25 and 26, on which a brief statement of these exceptions may be made, see pages No. 24, Fig. 3.

Six subdivisions are also used under each of the headings E and G for the classifying on Form No. 28 of the many sources under the various types of distribution:

ELECTRIC.

E-A For asymmetrical distributions.
E-B For principal intensities between ....15° and 30°
E-C For principal intensities between .... 0° and 15°
E-D For principal intensities between ....30° and 45°
E-E For principal intensities between ....45° and 90°
E-F For arc lamps and multiple lamp sources.

Data indexed in Section F will also be found under the other sections according to the light distribution characteristics of the unit. The arc lamp and multiple lamp source classifications are supplemental as a matter of convenience.

Section G is similar in every respect to Section E, with the one exception that gas sources are here recorded instead of the electric.

Each of the forms, 25, 26 and 27, is on yellow paper, with nine columns of 28 lines each, having spaces of such size that they may be filled in on a standard typewriter, using the regular spacing, without the lines interfering. As reports of tests are received they are entered on these yellow sheets, forms Nos. 25 and 26 for electric or Nos. 25 and 27 for gas.

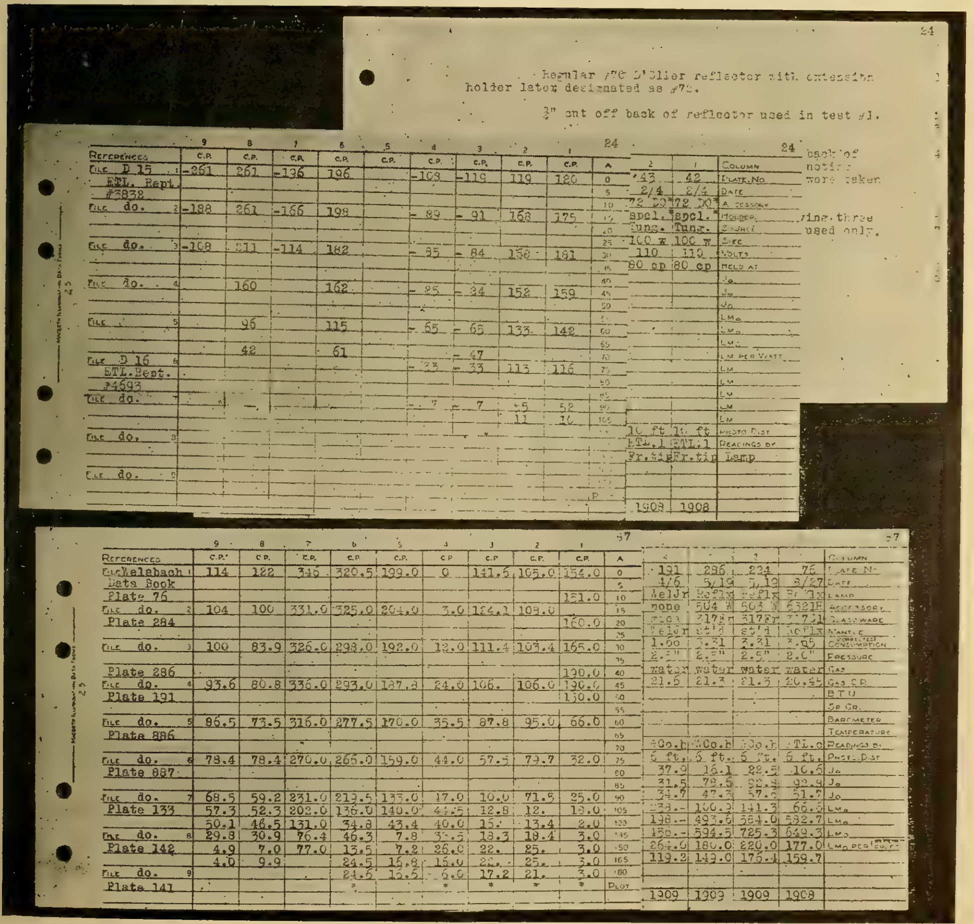


FIG. 3.—RECORD SHEETS FOR PHOTOMETRIC RESULTS.

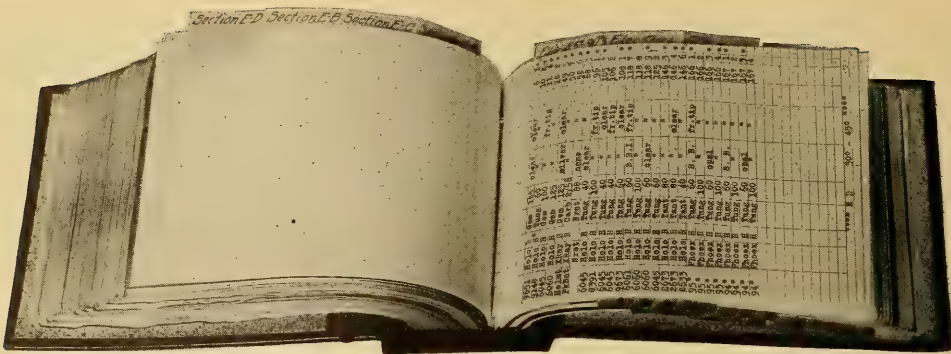


FIG. 4.—RECORD SHEETS FOR DISTRIBUTION CLASSIFICATION.

One column suffices for the intensity values from one source and equipment as investigated ordinarily on a photometer at any or all the usual angular divisions from 0° to 180°, using either the 10° or 15° positions, except in the case of asymmetrical distributions when two or three columns depending upon the planes investigated or reported upon may be required. Then with the numerical values from which a curve may be plotted tabulated on Form No. 25 the data covering the test conditions accompanying same is tabulated in the correspondingly numbered column on Form No. 26 or 27, according to whether the source be electric or gas. On these forms, spaces for all the variables and constants which must necessarily be noted in connection with the measurement of light intensity of gas and electric sources are properly designated, together with additional lines for flux and efficiency statements. The No. 25 sheets are numbered consecutively and are set aside in quantities of ten or more at a time for Section E or G, as may be required.

After the data has been thus entered it is indexed in alphabetical order on Form No. 28 under three headings, viz.:

Manufacturer's name, subdivided as to catalogue numbers; kind of lamp, with subheadings for various sizes, and type of distribution.

Reports of tests (Form No. 25) on available or commercial units, which appear for reasons of efficiency or effect to be desirable, are plotted on the flux-polar paper, with a brief statement of the test conditions filled in on the footing, Fig. 1.

Ordinarily for a source having a symmetrical distribution in the vertical plane but one side of the polar curve is plotted; this, for convenience in reading, is the right hand side. A protractor may be more readily held with the left hand, the readings noted and written down with the right. With left hand writers this order should, of course, be reversed.

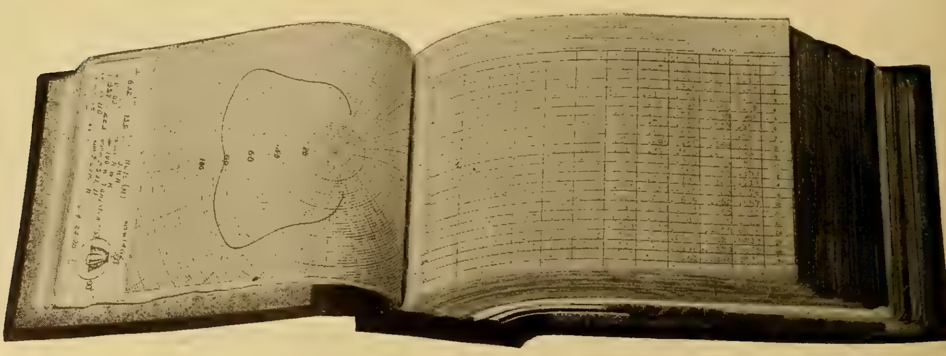


FIG. 5.—ILLUMINATION AND FLUX-POLAR FORMS.

When the illumination values of a given light unit are required, as, for example, one having the most of its flux useful within 30 to 40° from the vertical, reference is made to section G-D or E-D, where all units having that type of distribution are grouped. Each page of this group, Fig. 4, shows the accessory catalogue number, manufacturer, holder, kind and size of lamp, finish of the reflector; finish of lamp, chimney or globe; the page whereon the distribution values at the various angles are tabulated and column of that page. If these values have been plotted on a polar sheet it will be indicated by an asterisk or a small check mark in the last column.

After the illumination has been worked out for any height, a blue sheet (Form No. 24) is used to tabulate same, this page being numbered the same as the original entry sheet, with the column number added. For example, the flux-polar curve plotted from the values in column 1 on page 96 is then numbered 961, and checked in space at bottom of column 1, page 96 (Form No. 25), marked "Plot." When the illumination for any height is worked out from this curve then the blue sheet on which these illumination values are noted is also numbered 961.

In this way should any sheets become mixed up the connection is readily apparent.

An example works out as follows:

It is desired to refer to the best available illumination distribution from a 100-watt tungsten lamp and reflector hung 9 ft. above the plane in a room 15 ft. wide.

The angle between the light source and each side of the room at the height of the plane is about 40°. Reference may be made to "tungsten 100 watt" sheet for a "D" distribution or to Section E-D of the "distribution" index, Fig. 4, where by running down the fourth column, "kind of lamp," we note the first tungsten is a 100-watt lamp, is a frosted tip lamp, equipped with No. 8391 Holophane clear reflector and H. holder. The data is given on page 96, column 1, and as there is an asterisk in the last column the curve has been drawn on a polar sheet numbered 961.

Reference to the front of the book where those sheets are kept, with the last page on top and referring to the blue sheet No. 961 facing the flux-polar sheet, Fig. 5, the illumination intensities on a horizontal plane for a height of 9 ft. have been worked out and the values are given for all even distance points. Had it been necessary to make the calculations for this height a transparent, celluloid protractor would be used, on which have been drawn only the lines corresponding to the angles made by lines from 1, 2, 3, 4, etc., feet distance on a horizontal plane to a source 9 ft. high. This protractor is laid on the polar curve and the candle power values read at the intersecting radial lines, rendering unnecessary the rather difficult matter of estimating the odd angles to read on paper which is plotted with 5° angles only. Similarly constructed protractors (Fig. 6) are made for each foot and half foot height from 5 to 15 ft. These protractors may be used with the metric system as well as the English, reading in either meters or feet.

Each candle power value is then set on an illumination calculator, Fig. 6 (a circular slide rule device designed by the writer two years ago, see ILLUMINATING ENGINEER, March, 1908), against the corresponding angle, and for the height

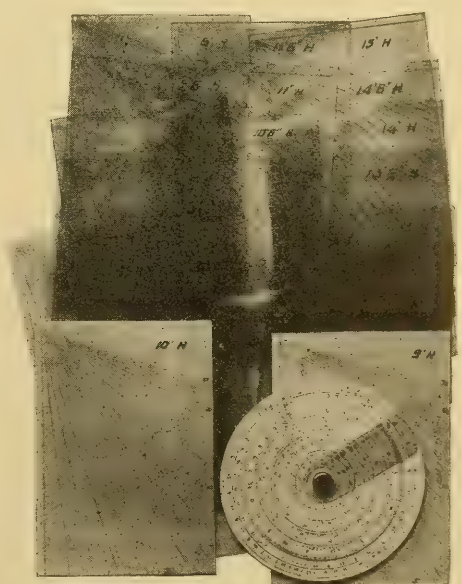


FIG. 6.—PROTRACTORS FOR ODD ANGLES, FOR EVEN HEIGHTS AND DISTANCES AND MACBETH ILLUMINATION CALCULATOR.

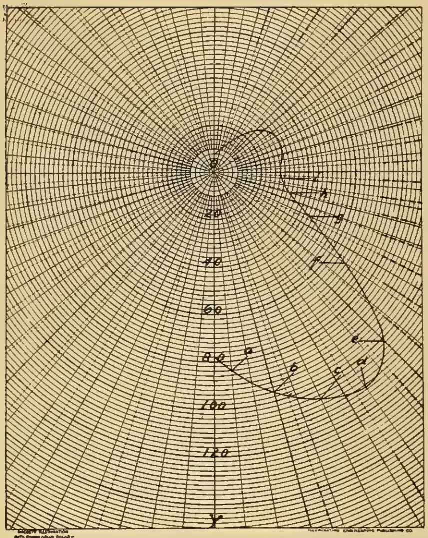


FIG. 7.—FLUX-POLAR FORM.

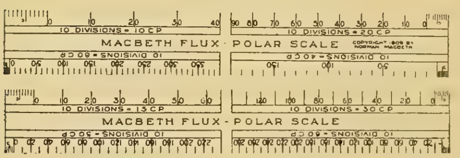


FIG. 8.—FLUX-POLAR SCALE.

desired the result is read in illumination intensity units—foot candles, meter candles, etc., according to the system of units used. This entire operation to secure the values for the illumination intensity on a horizontal or normal plane from directly below the source for each one foot point to 10 ft., and the two foot points from 10 ft. to 30 ft., requires about ten minutes' work. With arc lamps or sources of a size used for large interiors or exteriors the height and distance values on Form 24 may be increased ten times—reading to 300 ft. or meters. The data noted on these blue sheets is used to determine the spacing or arrangement of lights for a uniform or localized type of distribution as may be desired, and to enable a point to point calculation to be made in a few minutes. Other than for deciding this one question of spacing, slight importance is attached to the resultant calculated values. The total number of lamps or units is generally taken care of by a gross calculation based on "experience factors" of "cubic feet of gas per square foot" or "watts per square foot" per hour.

Flux calculations may readily be made, using "flux protractors,"* a modification of the method first described by the writer in the ILLUMINATING ENGINEER, March, 1908. These protractors may be made to use on any polar diagram for mean upper or lower hemisphere, mean spherical and the zones of 20°, 30°, 45°, 60° and 75° from the vertical. The results secured are in terms of mean candle power, which may be converted to lumens by multiplying the result by that proportion of the area of the sphere under consideration, the factor being 12.57 for total lumens; 6.28 for the upper or lower hemispheres, and .379, .842, 1.84, 3.142 and 4.66, respectively, for the lumens effective within the zones given above.

To determine the mean upper or lower hemispherical candle power or mean spherical without the use of a flux pro-

* ILLUMINATING ENGINEER, January, 1909, page 610, and Transactions, Illuminating Engineering Society, 1908, page 526.

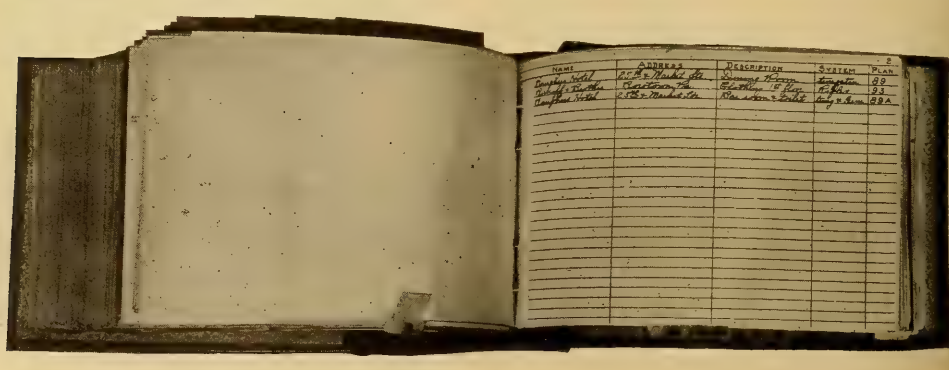


FIG. 9.—INDEX SHEET FOR PLANS ALPHABETICALLY ARRANGED.

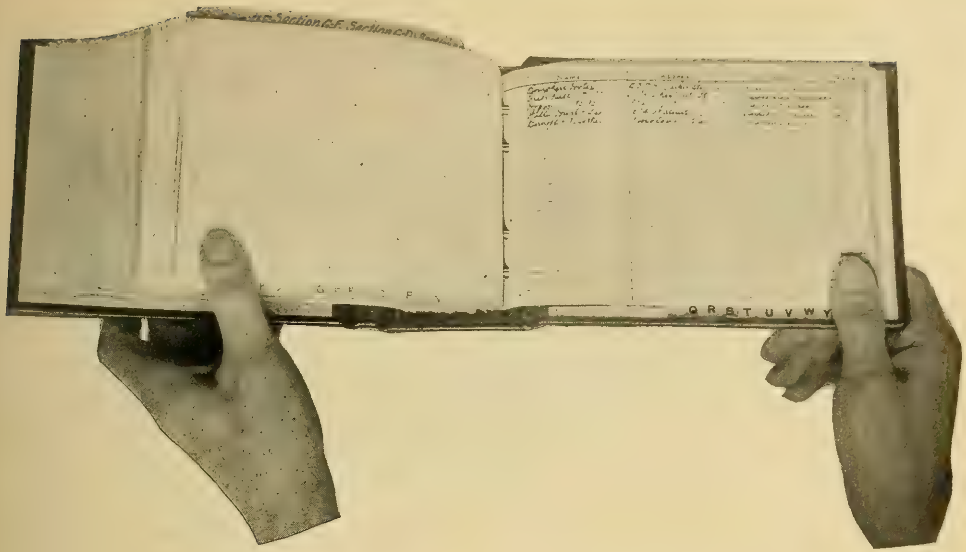


FIG. 10.—GENERAL PLANS OF INDEX SHEET.

tractor from a curve plotted on the flux-polar paper, Fig. 7, it is only necessary to add together the values of the candle power read at the intersection of the curve with the ten dotted lines in the upper or lower hemisphere, and point off one figure to the left in the result—that is, divide the sum by ten. The average of the mean upper and lower hemispherical candle power gives the mean spherical candle power, or the sum of the 20 readings in the upper and lower hemispheres may be divided by 20. This method admits of results well within the limits of commercial accuracy, and has the advantage of a considerable saving in time over other more elaborate methods.

This flux-polar diagram is based on the well-known Rousseau diagram as used without a planimeter when it is assumed that a reading taken at the intersection of the distribution curve and a perpendicular line in the center of each of the ten equal area zones, in the upper and lower hemispheres, represent the average intensity for each of these zones.

Referring to the curve plotted on Fig. 7, the mean lower hemispherical candle power as read on the dotted line intersections is 99.8 + 110.2 + 107.1 + 87.1 + 62.9 + 47.2 + 38.1 + 32.3 + 29.7 + 28.3 = 642.7 = 64.27.

A later and more convenient method of determining the flux within certain zones has been adopted along the lines suggested by J. S. Codman and T. W. Rolph* by the use of a "flux-polar scale,"† a rule scaled in proper relation to the standard flux-polar paper here illustrated and adopted by the writer over two years ago in the convenient size of 5 x 8 in. This rule is less than a vest pocket size, being ¾ in. wide and 5¼ in. long. Both sides are shown in Fig. 8, on which may be noted the eight scales proportioned to use with the candle power scale values most usual, viz., 10, 15, 20, 30, 40, 50, 60 and 80 candle power to each ten small divisions, or one main division of the flux-polar diagram. This admits of plotting the polar curve of the light unit, which has been investigated photometrically, to the most convenient scale consistent with the size of the sheet, thereby rendering ease of reading and legibility possible. The zonular values are then read direct from the scale in lumens, or by giving the scale half or twice values, the curves plotted to 5, 25, 100, 120 or 160 candle power may also be read.

Using that scale to which a value has been given corresponding to the number

* ILLUMINATING ENGINEER, May, 1909.

† Transactions of Illuminating Engineering Society, 1909, page 798.

FIG. 11.—LOOSE LEAF, FLEXIBLE COVERED BINDER.

of units per division to which the curve has been plotted, read the value of the horizontal component of the candle power at the intersection of each angular division of 5°, 15°, 25° for the flux within the respective zones of 10°, 20°, 30° and so forth.

That is, measure with the scale the length of the horizontal line which may be imagined as drawn from the vertical or 0° to 180° line to where the polar curve intersects each 5° midsection line in each 10° zone. Add these values together and the result is the total lumens for the zone bounded by the angular division 5° greater than the last angular intersection at which a reading has been taken.

Example: The polar curve, Fig. 7, is plotted with one large divison or ten small divisions to equal 20 candle power. Then to calculate the flux in the zone 0° to 90°, use that scale which is designated "1 division = 20 candle power." Lay this scale on the polar curve, keeping the scale parallel to the lower edge of the paper—that is, at right angles to the O-Y line—and read off the distance from this vertical line to the intersection of the 5° angular division, a, with the distribution curve. The other measurements are then made to the 15°, 25°, 35° and each 10° addition to the 85° point (*b* to *i*), and the sum of the nine readings gives the lumens effective within the 90° zone. The readings are 5°-8.0, 15°-27.5, 25°-49.1, 35°-70.0, 45°-78.4, 55°-60.9, 65°-44.0, 75°-35.0, 85°-31.5 = 404.4.

The sum of the readings at 5° and 15° will give the lumens effective in the zone of 20° = 35.5 lumens. Add the 5°, 15°, 25° and 35° readings for the lumens within the zone of 40°, and so forth. The mean candle power in any zone may be secured by dividing the zonular lumens by the multiplying factors given above for the conversion of mean candle power to lumens, with the addition of 2.24 for 50°, 4.13 for 70° and 5.19 for 80°.

With this scale estimated readings are not necessary, as the end large division on each scale is divided into ten, permitting lumens to be read directly, and tenths by interpolation on the 10, 15 and 20 scales.

In the alphabetical index, ruled sheets, Fig. 9, are filed under each letter A to Z, on which a record is kept of all plans or sketches coming into the office for clients, with a cross index under windows, clothing stores, drafting tables, factories, etc.

The method adopted is as follows:

When work is taken up for any party,

if plans or sketches have not been submitted, a rough sketch is made with special attention to the length, breadth of room or floor, height of ceiling, number and position of outlets, height and character of lighting units then installed. Any irregularities, such as changes in floor or ceiling height, position and size of beams, location and size of doors, windows, partitions and stairways, are noted on this sketch, approximately in their proper position, in all cases having the dimensions given, rather than any close attempt at a scale drawing.

As these sketches or plans come in reference is made to the sheet similar to page 2, Fig. 9, in the alphabetically arranged index. If this is the first operation for this party, no name appears under their initial, and reference is then made to the general "plans" sheet (Fig. 10), under letter P. The name, location, etc., is then entered and the sketch given the next number vacant.

However, had it been found on first reference to the index that sketches or plans for this party had been previously filed, the latest sketch is given the same number, with a letter added. Thus, Bourgher's Hotel may have had work at two different times or places and the sketches would be labeled, for example, 89, 89A, and the next sketch therefore would be 89B. In this way each commission is independent, though linked by the key number to all work done for the same party. These rough sketches are finally placed in a vertical file, with folders numerically arranged, and all of "Bourgher's Hotel" sketches would be filed in folder No. 89.

When it is found necessary or desirable to furnish blue prints a tracing is made with the position, etc., of the proposed outlets shown, and their relation to the present or old outlets. This tracing is marked the same as the sketch, the key number and letter number being inclosed in a ¾-in. circle. Where one set of rough sketches having the same job or key number may require one or more tracings, the customer's number, job letter and tracing number added by hyphen are placed in the lower corner on each. The tracings are therefore further designated with the additional number, "89-C-1," "89-C-2," etc.

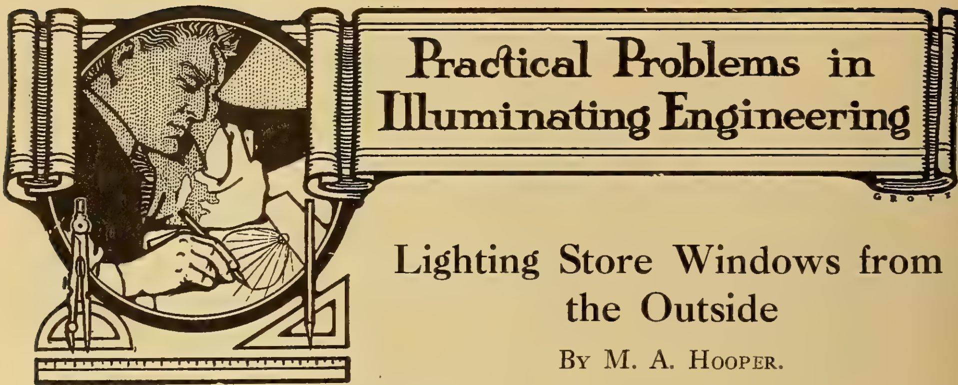
Designs for fixtures submitted or approved are likewise marked as drawing "89-C-3," etc., in addition to the design number. The design number appears in the upper right hand corner as a Roman numeral, and a blue print of each design is filed in the order of this Roman numeral in a large 9 x 14 in. loose leaf book. Then in the loose leaf price-book, costs of these fixtures may be found through the Roman numeral designation.

All the above form sheets, excepting the yellow sheets Nos. 25, 26 and 27, may be used for blue printing, and excellent prints may be secured from typewritten matter if a carbon paper has been faced on the back of the sheet written on, which makes the letters quite opaque.

For rapid reference to page numbers, the sheets Nos. 24 and 25 are shorter than the flux-polar and form Nos. 26 and 27 sheets, so that in ruffling the sheets from left to right the pages always open between the flux-polar and the corresponding illumination sheet, or with Form No. 25 on top rather than having to turn backward or forward from Form No. 26 or 27.

For outside work a loose leaf, split ring binder, Fig. 11, has been found quite useful. This binder contains only a condensed index, Form No. 24 sheets, giving the illumination values for various heights and distances and the corresponding flux-polar sheets, which in each instance are inserted in the book facing the illumination sheet.

The above described series of records and system of compiling data will enable the engineer who depends upon results and the quick determination of the "shortest distance between two points" to more completely and conveniently secure the information desired than is possible with an office full of filing cabinets and card systems, with less liability to "systematism."



Lighting Store Windows from the Outside

By M. A. Hooper.

The subject of store window lighting has received a great deal of attention within the past few years. This has been due partly to the increasing importance of the subject, owing to the greater number of people using the streets by night, and partly to the improved light-sources and accessories which have made more impressive effects possible. The so-called decorative street lighting, consisting generally of ornamental lamp-posts placed along the curb, has also received a still greater amount of attention.

It has come to be rather generally believed that effective store window lighting must be done from the inside and the light-sources entirely concealed from view. The objection to outside lighting has been that the light-sources would detract from the illumination of the goods in the window. Whether this is the case or not, the decorative lighting system along the curb has produced the condition of outside lights.

If both decorative outside lighting and inside window lighting are good, then a combination of the two can certainly not

FIG. 1.—STORE WINDOW ILLUMINATION, WILMINGTON, DEL.

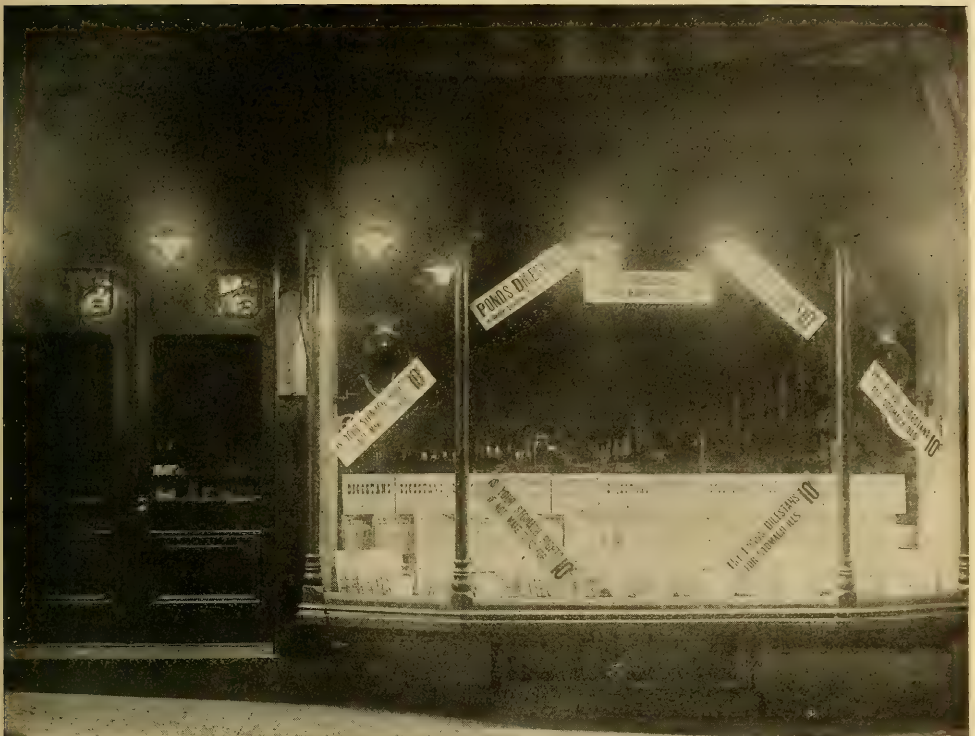


FIG. 2.—A WILMINGTON, DEL., DRUG STORE.

be very bad. A number of installations serving this double purpose are shown herewith. The lamps used are the outdoor type, single mantle, inverted gas lamps. These lamps give 100 candle power each, and can be operated at a cost of less than ½ cent an hour. The lamps are hung across the front of the show windows, from 22 to 30 in. apart, according to conditions. As the photographs show, the windows are exceptionally well illuminated, the goods showing distinctly and attractively.

Combined with the window lighting there is the great additional advantage of the brilliant illumination on the sidewalk and the rows of light-sources in themselves, which serve both as a sign, showing the location of the stores and as a means of special street lighting.

The installations have given satisfaction to both the users and the public, and demonstrate that modern gas illumination is not only practicable for decorative exterior use but is capable of giving results equal to that of any other luminant.

FIG. 3.

A Large College Gymnasium

By Leo J. Cleary.

A recent change in the lighting installation of the Notre Dame University gymnasium makes it one of the most brilliantly illuminated gymnasiums in the country. The gymnasium is unique in point of size, being 98 x 150 ft., and has a dirt floor, another disagreeable factor for the illuminating engineer. Originally eight 200 candle power inclosed flame arc lamps, using 660 watts each, were hung at varying distances from each other 17 ft. above the ground. The result was far from satisfactory.

In January, 1910, a change was made to four regenerative flame arc lamps of 3500 candle power each. The lights were arranged in the form of a square 35 ft. apart in the center of the room, 28 ft. above the ground, cut-outs being used in order to do away with the dangling wires. It was found that the total wattage for the 14,000 candle power amounted to 3080, as against a total wattage of 5280 for 1600 candle power of the original system; thus giving nine times the former candle power at an expenditure of only three-fifths the current. Cages were put over the lamps so they would not be injured during baseball practice; and the brilliant illumination made baseball in the evening easily possible. During the winter months the gymnasium is used all evening by the different classes of the university for track, basketball and baseball practice, the large floor space permitting the laying out of a regulation baseball diamond. The greater part of the illumination at the university is by tungsten lamps. In one dormitory building recently erected at a cost of $100,000 no less than 200 bowl-frosted tungstens are employed. In the classrooms "extensive" prismatic reflectors are used, while in a few cases of narrow rooms the "intensive" reflectors are used.

The large "gym" has been a great factor in the success of athletics at this institution, and several college gymnasiums erected throughout the country lately with the Notre Dame structure as a model.

The greater part of the interior illumination of Notre Dame University is by tungsten lamps now. The change was made with a view to increasing the brilliancy of illumination rather than the saving of current, but the results have been highly satisfactory from both standpoints. In one case four times as much light was secured with a third additional current; while in another case one-third more light was obtained with only two-thirds the original current.

In the classrooms the lights are placed 8 ft. above the plane of illumination; "extensive" reflectors are used in the larger rooms, and in the case of narrow rooms the intensive reflectors are employed. In Walsh Hall, the new dormitory building recently erected at a cost of over $100,000, more than 200 tungstens are used.

Combination Tungsten and Gas Arc Illumination in a Store

By W. H. Haight.

Both the tungsten lamp and the modern gas arc have advantages peculiar to themselves. In point of color their illumination is equally good. The greater amount of heat of the gas arc, while objectionable in summer, is a positive advantage in winter. Owing probably to natural conditions of competition, it is seldom that installations combining the advantages of both these modern systems are put in at the present time. From the consumer's point of view at least there is not the slightest reason why these two modern light-sources should not be used side by

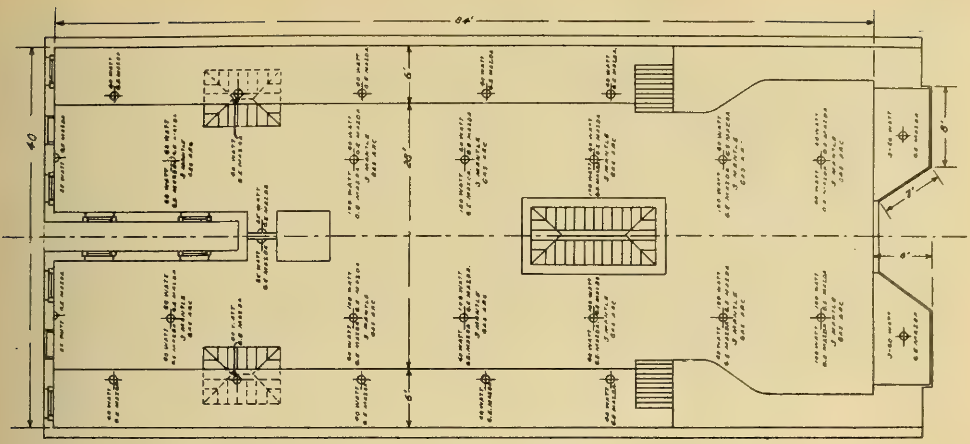
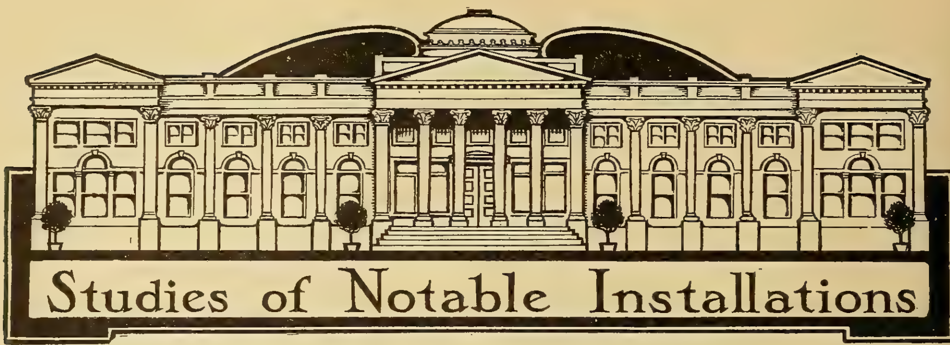


FIG. I.—PLAN OF STORE.

side. The installation described is an effort in this direction.

The plan of the store and the location of the units is shown in Fig. 1. Photographs of the interior with both systems in use show that the illumination is both well distributed and ample for the purpose. The flexibility of such a system is evident. When a moderate amount of illumination is wanted, the tungsten units can be thrown into service; and when a particularly brilliant general illumination is required, both systems can be put in operation together.

FIG. 2.—DEPARTMENT STORE ILLUMINATION, RIDGEWOOD, N. J.



The Home of Thomas A. Edison

There is a proverb to the effect that "a shoemaker's children are always barefooted." This saying expresses a common tendency of human nature to overlook the good which is nearest at hand and to reach out for that which is difficult to grasp. No single name stands out so prominently in connection with the electric light as that of Edison, and it is certainly an interesting question whether the adage of the shoemaker's children will hold in his case in regard to his own use of the lamp which is so inseparably connected with his name. Mr. Edison certainly has the financial means and the technical knowledge to have any kind of

FIG. I.—LIBRARY, HOME OF THOMAS A. EDISON.

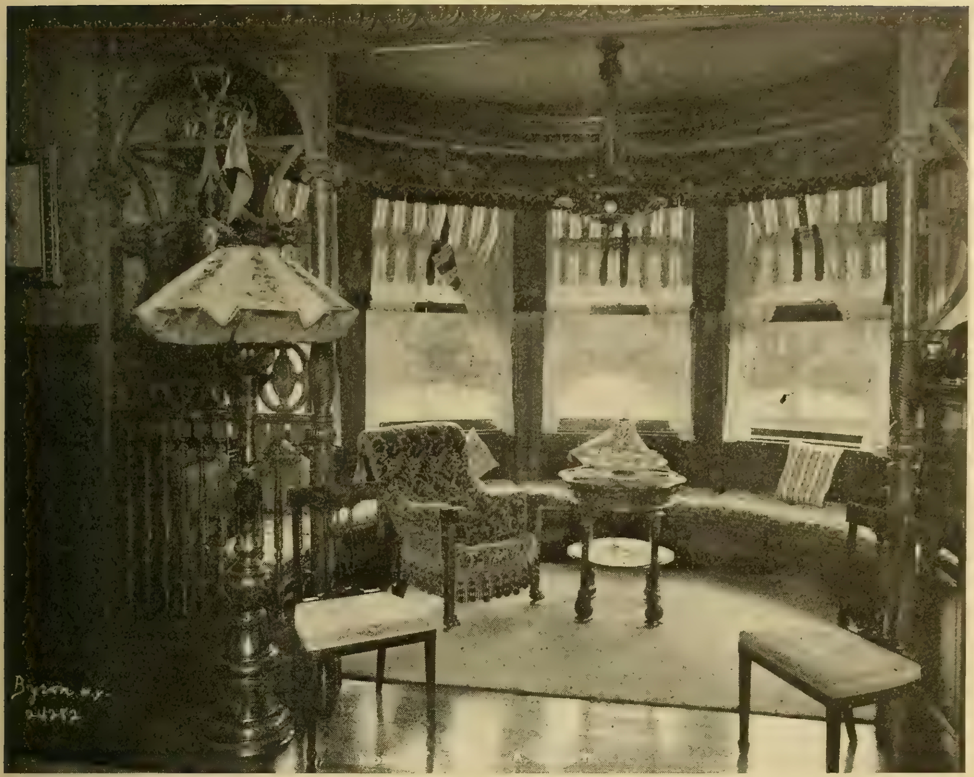


FIG. 2.—SECTION OF ONE OF THE LIVING ROOMS.

illumination or illuminating devices which are obtainable. The manner in which his home is lighted is therefore a point of curiosity as well as of technical interest.

His residence is a fine mansion, though by no means extravagant in its architecture or materials, located in the little town of Menlo Park, N. J., where his first successful demonstration of the incandescent lamp took place 30 years ago.

A view of his library is shown in Fig. 1. The illumination here is by a handsome portable lamp on a large standard resting upon the floor, with wall brackets for general illumination. This lamp is at once decorative and highly useful, affording the best possible illumination for reading when so placed that with regard to the chair or settee that the light will fall over the shoulder. The brackets are equipped with frosted globes, which give a fair measure of diffusion.

Fig. 2 is a section of the living room. The lamp standard resting upon the floor is again in evidence. For general illumination a chandelier of unusual design is provided.

The dining room is shown in Fig. 3. Here a silk covered dome furnishes the illumination for the table, while a ceiling fixture with lamps inclosed in small beaded globes supplies the general illumination, side brackets also being used.

In Fig. 4 we have a view of a bedroom, in which an eight-light chandelier furnishes the illumination, clear lamps in frosted globes being used.

The one general conclusion from these illustrations is that there is nothing whatever unusual in the lighting appliances of this home; they are of such a character as might be found in thousands of homes of a similar class throughout the country. With the exception of the bedroom, the lighting is undoubtedly entirely satisfactory, but in the latter case the clear lamps pointing out in so many different directions are certainly open to criticism. The

installation shows no signs whatever of having been studied or designed by the famous inventor. It is just such an installation as might be expected to result from the combined efforts of the architect, fixture maker and decorator, and is neither better nor worse than the average installation in a house of this type.

Among all the numerous American inventors of lasting fame none has perhaps attracted greater attention or received a greater share of appreciation from his contemporaries than Thomas A. Edison. One of the reasons for his remarkable popularity is to be found in what may be rightly called his Americanism. He represents in its highest form the typical American inventor; the American is nothing if not practical. Almost all of Mr. Edison's remarkable success is summed up in this single word—practicality. Where others theorized he executed. Where others dreamed he performed. Where failure had resulted from lack of persistence he conquered by sheer force of almost endless research. As in the case of all other great inventors, his title to the discovery of the incandescent electric lamp has been often and seriously questioned.

Undoubtedly the ideas which made the electric lamp possible were conceived and more or less executed before Edison turned his attention to this new luminant, but that he sifted out the useful and embodied it in a practical lamp there is little room for dispute. It is an open secret that in the process of the growth and development of the electric light with the combination which inevitably takes place between the numerous pioneer companies Mr. Edison considered that his rights had been infringed, that he had not received the financial return to which he was justly entitled. On this account he resolved firmly never again to attempt any further invention or improvement in this important electrical industry, and he has been true to his word.

It is a curious fact that the latest forms of incandescent lamps which have actually

FIG. 3.—DINING ROOM.

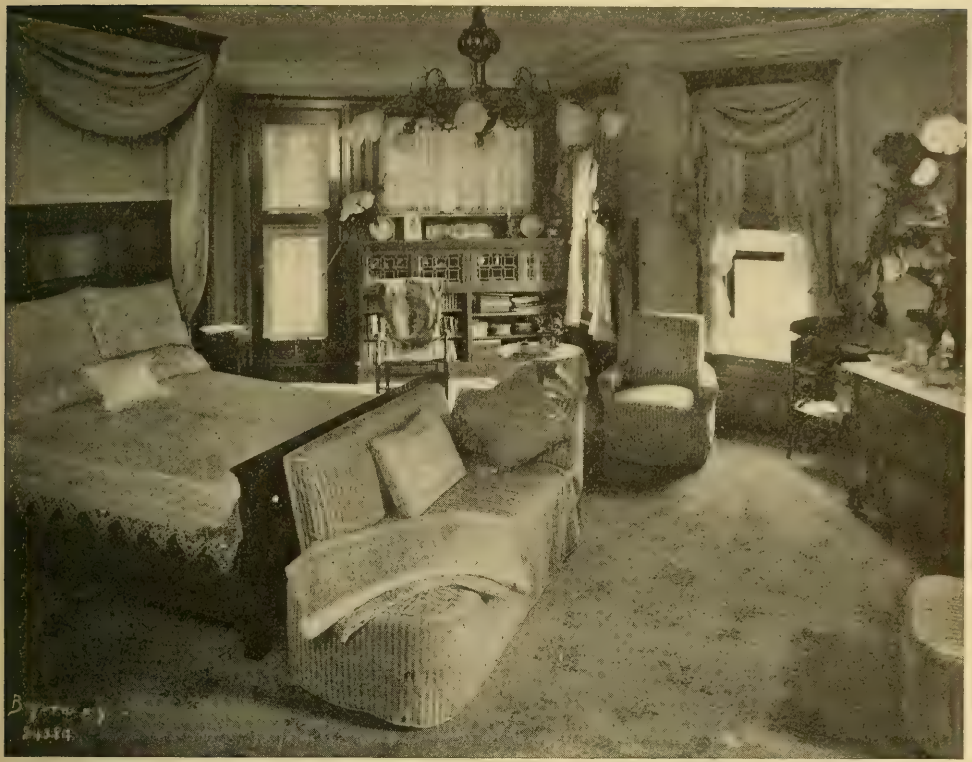


FIG. 4.—BEDROOM.

revolutionized electric lighting are made upon the principles which attracted the attention of the great inventor in perfecting the well-known carbon filament lamp which so long was known by his name. In a search for suitable material to withstand high temperature without being destroyed he first worked with the metals having a high fusing point, but as platinum was the only one within commercial reach his efforts were unsuccessful. The discovery of means of isolating the rare metals of still higher fusibility to which electricity itself has highly contributed is the real source of the present high efficiency lamp.

While Mr. Edison has done excellent work since he forswore all allegiance to electric light, it is, nevertheless, regrettable that the world has been deprived of his remarkable energies and talents along these lines.

Fixtures and Accessories

Artistic Gas Fixtures

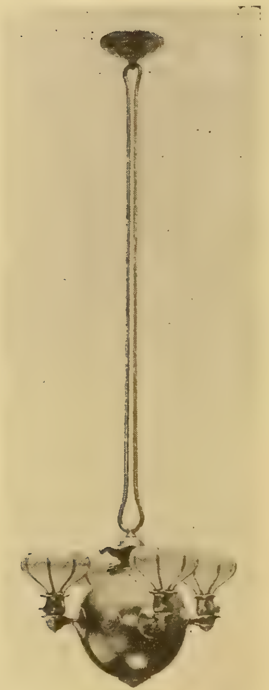


FIG. 1.

The National Commercial Gas Association wants to know why fixture manufacturers do not design as artistic fixtures for gas as for electric light.

The question implies that artistic gas fixtures are not being manufactured; but before seeking too diligently for an explanation, it may be well to first inquire into the truth of the implied fact. While looking into this question it may also be well at the same time to find how far the claim that the inverted burner is susceptible of more artistic treatment than the upright is based upon fact.

Fig. 1 shows a gas fixture of simple but artistic design of Art Nouveau tendency. Besides being artistic in itself, it entirely hides the identity of the light-source, so that it would be quite impossible for the observer to tell whether it were a gas or an electric fixture. It is made to take a small upright mantle burner of special design. This fixture has been catalogued

FIG. 2.

FIG. 3.

by the manufacturer for a considerable number of years.

Fig. 2 is a chandelier of the French school, adapted to the standard upright mantle burner, fitted with a special chimney. The mechanism of the burner in this case is also entirely hidden from view, as it should be in all cases where artistic effect is desired. This holds quite as true with the electric light as with gas.

Fig. 3 is a fixture of classic design, the Roman lamp being the central motive. While the mechanical parts of the burner are concealed in this case, the fact that a flame light-source is used is frankly indicated by the chimneys projecting above the globes. This carries out the spirit of the motive much better than is the case when electric lamps are used for a similar purpose.

Fig. 4 shows another chandelier in which the more modern oil lamp is suggested. This fixture was made for the residence of a well-known Standard Oil millionaire.

Fig. 5 shows a special fixture recently designed, which for richness of material, elaborateness of design and expensiveness of finish is rarely exceeded in the case of any single piece. The bowl is of an intricate pattern of cut crystal glass. The metal is hand engraved bronze, finished in dull gold. The fixture measures seven feet in length and two feet four inches in diameter, and cost the purchaser $1,500.

Fig. 6 shows another special fixture equally expensive and elaborate in its design. The under cutting of the metal is particularly noteworthy. The glass shade is an exquisite piece of engraved crystal. The fixture is seven feet four inches long and two and a half feet in diameter. In both of these latter fixtures the inverted burner is used.

The first four fixtures shown are by no means exceptional cases, but are examples taken from the regular lines of a single manufacturer. The answer which they give to the question is plainly this:

FIG. 4.

FIG. 5.

Artistic gas fixtures not only can be made, but have been made for years, and regularly offered for sale. The two special fixtures shown answer the question in a different way. Quite as artistic and expensive fixtures can be and are designed for gas as for electric light.

Undoubtedly much less attention is being given to artistic gas fixtures at the present time than to electric fixtures, but this is simply the result of the law of supply and demand. Since the gas interests allowed gas lighting to fall into second place as a luminant, and to depend for its use upon the single advantage of cheapness, nothing else could be expected than that cheap fixtures would be demanded, and this is surely what has happened and is the sole cause of the condition existing to-day in regard to gas fixtures.

The claim that the inverted burner renders more artistic fixtures possible is not substantiated by the examples given herewith, nor can it be maintained by any process of reason or fact. The electric lamp is rather more often than otherwise placed in the upright position when artistic effects are particularly sought for. The upright gas burner has the advantage of giving no discoloration of metal work, which is a serious matter in the case of the inverted burner. The inverted burner is a concession to efficiency rather than an addition to artistic possibilities.

This does not mean, however, that the inverter burner is not adaptable to artistic effects. On the contrary, it is capable of quite as decorative treatment as the electric lamp placed in the same position.

When artistic gas fixtures are demanded by the publc they will be promptly produced by the manufacturers, but they cannot be expected to exert themselves to produce fixtures for which there is little or no demand.

FIG. 6.

Fixtures for Indirect Lighting

FIG. 1.

The increasing use of this form of illumination has presented a new problem to the fixture designer. While modern light-sources may be used to simulate lamps and candles and fixtures designed in accordance with models and traditions that have prevailed for thousands of years, there are absolutely no precedents to follow in the case of indirect lighting, the very essence of this system being the complete hiding of the source of light. That the method is capable of artistic treatment, however, is clearly shown by the few examples here given.

Fig. 1 is a commercial fixture which at least equals in decorative merit the better class of commercial chandeliers. It is designed for large interiors in which correspondingly large units are preferable, and is fitted for the use of 60 or 100 watt tungsten lamps in pendant position. The bowl which holds the reflector can be easily lowered for cleaning or replacing lamps. A favored finish is brushed brass.

Fig. 2 is a design by Mr. Lescher of the architectural firm of D. H. Burnham & Co., Chicago. The original design was entirely of cast metal, but it is now produced with a stamped bowl with metal supporting ring and ceiling piece. The treatment is severe to harmonize with classic architecture. It is most effective in bronze trimmings.

Fig. 3 is a fixture designed by a prominent Chicago architect for use in his own home. The treatment is distinctly of the "new art" type, which has been developed to a greater extent perhaps in Chicago than in any other section of the country. It may appropriately be given a brushed brass finish. In both of these fixtures the lamp is held in a vertical position.

The fixtures here shown are of solid metal. This is necessary in order to use a silvered glass reflector, the surface of which must always be protected, and is therefore entirely opaque. This type of reflector is used in order to secure the highest amount of reflected light, since the total efficiency of the system depends largely upon this factor.

It has been objected to this type of fixture for indirect lighting that the metal bowl, or casing, which constitutes its principal part, becomes simply a black object without detail when the lamps are in service. This objection is not strictly true. In fact, the object of indirect lighting is to secure an approximately uniform illumination not only upon the floor or some plane near it but throughout the entire space of the room. One of the chief advantages claimed is that there are no black shadows at any point. The fixture is therefore illuminated to a certain extent, which, if the apparatus is properly designed, is sufficient to show at least the principal details of the design.

Again, it may be said in defense of this type of fixture that it presents no greater extent of metal below the lamp than many of the chandeliers, especially those which are designed with the Roman lamp as the motive; also that the general illumination produced will relieve the shadows to a much greater extent.

There is an opportunity for legitimate decorative construction in this class of fix-

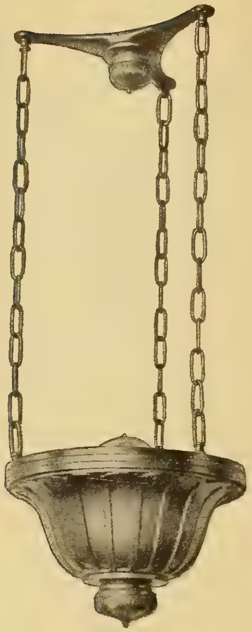


FIG. 2.

ture which has yet been scarcely utilized, and that is on the supporting mechanism on the ceiling. In the examples given this is an almost perfectly plain, three-arm "spider," to which the supporting chains are attached. This could be elaborated to almost any extent without transgressing the principles of decorative art, and would have the advantage, which does not obtain in the ordinary chandelier construction, of being perfectly illuminated when the lights are on. If given a gilt or silvered finish it would be almost as reflective as the ceiling, but in any case would interfere very little with the final efficiency of the system, as the amount of light intercepted is small.

Where units for this system of indirect lighting are used on chandeliers the same general principles may be applied. As the metal bowls are simply protectors for the glass reflector within, they may be made of any form that will receive the reflector. Thus the bowl of the Roman lamp could be produced with exact fidelity, the balance of the fixture being designed in harmony. To carry out this idea to perfection it would be a simple matter to have a small straight gas jet that could be lighted, imitating the actual oil flame of the lamp.

FIG. 3.

Intensity of Illumination or Visual Acuity

In laying out lighting installations, as well as in measuring the illumination of those already in use, it is the present practice to determine the intensity of illumination upon some chosen plane. This is unquestionably an important measurement, but it is not of itself conclusive as to the general effectiveness of the illumination. Light is used for the purpose of enabling us to see, and the extent to which it accomplishes this purpose measures the effectiveness with which it is utilized. Vision depends upon more than simple intensity; it would be quite possible to produce the exact intensity theoretically required and still have conditions that would be highly unsatisfactory and dangerous or destructive to the eyes. It is a question whether the measurement of illumination in the ordinary photometer, by which the intensity on a white surface is determined, is, after all, the most practical measurement. In practice we rarely are required to look continuously at white surfaces. We look at objects variously colored, and of various form, contour and texture, and the purpose of vision is to distinguish these properties. Thus, in reading or writing it is the black characters on the white surface which the eye is required to distinguish; and not for a minute or two, as in the case of making a photometer setting, but continuously. In all mechanical operations there are certain details of form, color and texture or surface which must be similarly resolved by the eye. The real test of illumination is, therefore, the ability of the eye not only to resolve these details distinctly but to continue this visual effort for a greater or less length of time. That such continuous action of the eye is dependent for its effectiveness and freedom from fatigue upon more than mere photometric intensity is well understood, but perhaps less followed than its importance demands.

The so-called visual acuity photometer is an instrument of far greater practical value than the theoretical photometerists have been wont to ascribe to it. Furthermore, there is much yet to be determined in regard to eye and nerve fatigue from the use of different kinds of illumination as applied to actual working conditions. Investigations of this kind are highly desirable, and those having the facilities and time for their prosecution should give the results of their work to the public.

Eyestrain in Health and Disease

The above is the title of a book by Dr. A. S. Ranney, which was published in 1897, a review of which appears in another section of this issue. In Dr. Ranney's work a large number of cases are reported where very serious illness, often of long standing, and which had baffled all the efforts of physicians, was entirely cured by the proper fitting of the eyes with glasses. The seriousness of the cases, as well as their number, is certainly astounding to the layman, and at once suggests the question, If organic or structural imperfections in the eye, causing undue strain of the organs in use, can result so disastrously, what must be the effect of eyestrain produced on normal eyes by the improper use of light?

While the strain may not be so serious as in the cases cited, there can hardly be a doubt that eyestrain resulting from any cause whatever, and especially if produced

for considerable periods of time, must have a far-reaching influence over the general health. The nervous system is the commanding force of every organ and function of the body, and no matter what the physical soundness or condition of the various organs may be, if deprived of this inciting power they are absolutely useless; their action must, therefore, be impaired to the extent to which the nervous force is reduced or interfered with.

Furthermore, the whole nervous system is more or less sympathetically connected. It is impossible to strain any particular set of nerves or nerve centers without affecting some other set of nerves. The nerve centers of the stomach and digestive organs and of the eyes are especially closely related. We have in mind one case of a woman who was nauseated on entering a large exhibition hall, which was lighted with extreme brilliancy. Seasickness has also been ascribed to efforts of the eye to find a resting place, or a point of equilibrium.

There is no single point in hygiene which should receive such careful attention as the care of the eyes, particularly in the case of children and women. On this subject the observations which Mr. Marshall relates are of great importance. In this instance a sixteen-year-old boy, otherwise in reasonably good health, was directed by the oculist to wear glasses. Systematic and careful use of the eyes with relation to the illumination, position in reading, proper periods of rest, etc., in two weeks' time enabled the boy to entirely discard the glasses, not only without inconvenience, but with a positive improvement in his general health, which particularly showed in his more equable disposition.

The amount of wholly unnecessary eyestrain, with its attendant evils of nervousness, indigestion and other disorders, that result from the methods of illumination to be found in the average office, store and home is something shocking to contemplate in view of the serious results of eyestrain which Dr. Ranney points out.

The Fixture Maker and the Illuminating Engineer

The paper by Messrs. Hopton and Watkins, the former the illuminating engineer and the latter the chief designer of one of the foremost fixture manufacturers in this country, which was presented at the last meeting of the New York Section of the Illuminating Engineering Society again brings to the attention of the fraternity the important question of the relation of illuminating engineering to fixture design and manufacture. The most important fact brought out at the meeting was the apparently complete change of attitude of both parties toward the question. The reading of a paper on the same subject and by one of the same authors three years ago precipitated a most lively and in some respects acrimonious discussion, seemingly irreconcilable differences of opinion being manifest. At the conclusion of the presentation of the paper the other evening it was difficult for the chairman to draw out discussion of any kind. Such as there was, was in the nature of commendation and agreement with the authors' statements.

The fact seems to be that both illuminating engineers and at least the more advanced class of fixture manufacturers have modified their views as a result of a better mutual understanding. The former has come to appreciate the fact that illumination in many cases is far more than a pure engineering problem, that questions of esthetics are connected with it, and that these questions belong primarily to the architect to decide, the illuminating engineer having only an advisory function in these matters.

On the other hand, the architect and fixture designer have learned that illuminating engineering is not essentially opposed to either the highest art in fixture design or the most effective results in point of esthetics. On the contrary, it can give very material assistance to the accomplishment of these objects, and in many cases enable them to be secured with a far higher degree of commercial efficiency without in the least interfering with their effectiveness. To put the matter very frankly, the architect and fixture designer have discovered and admitted that there were many things about the utilization of light and illumination of which they were ignorant and upon which they could receive valuable assistance from those who had made a special study of this subject.

On the other hand, the mushroom illuminating engineer has largely disappeared, and the really conscientious and competent engineers have learned that their authority over the subject of illumination is not autocratic and that questions of art and effect must sometimes take precedence over mere efficiency.

It was precisely this condition of mutual understanding and dependence for which THE ILLUMINATING ENGINEER has always contended. The best results are not to be had, at least under any ordinary conditions, by simple one-man authority, but by unreserved co-operation of the architect, fixture manufacturer and illuminating engineer.

Keep Going

There are many maxims setting forth the necessity of persistence of effort in order to accomplish results. Perhaps one of the best of these is used by one of the largest advertising agencies: "Keeping everlastingly at it brings success." If this is true in advertising—and who doubts it?—it is equally true in any kind of salesmanship. There is a tendency often manifested on the part of those dealing in lighting commodities to "let up" on the work at the approach of summer. "The off season is coming on," they say. One particularly successful constructing illuminating engineer thinks differently; the only off season that he knew was the time when he let up on his efforts to secure business, and this irrespective of the seasons by the calendar.

There is always plenty to do for those who are far-sighted, energetic and filled with enthusiasm for their work. True, there is less artificial light needed, at least for interior illumination, in the long summer days than in winter; but this very fact affords an opportunity for the remodeling of difficult installations and the careful planning and equipment of the new. The old saw of the man who could not shingle his roof when it rained, and did not need to when it was fair, applies. Light will surely be needed when the dark days of autumn come; and not only will it be needed, but the chief attention will be then directed toward other things than the installation of lighting apparatus by the user. There is little time then for change, experiment or consideration on the subject.

There is a certain amount of inertia in the human mind. It requires force to set it in motion or to stop it when once it is moving. "Large bodies move slowly," and there are some minds so bulky that it requires long continued efforts to produce the desired motion. The prospective customer who has been started on the road to better lighting during the "lighting season" should not be allowed to lose this momentum during the summer months, else the initial force will have to be re-exerted, which is often a more difficult task than the first effort. There is no valid reason for any cessation or relaxation of efforts on the part of those who are promoting the cause of "more light" during the long bright days of summer. Undoubtedly a greater amount of effort for a given amount of result is required, but this is no excuse for hesitancy: *Make the more effort.*

The N. E. L. A. Convention

The thirty-third convention of the National Electric Light Association will be held in St. Louis, May 23, 24, 25 and 26. This information is not given with the idea that it is news matter. Any one connected with the electric lighting industry, no matter how remote in location or interest, who has not heard of the time and place of this meeting must be without the use of the senses of sight, sound and touch.

The N. E. L. A. is a believer in publicity in every sense of the word; it believes in an aggressive propaganda for the interest which it represents, in season and out of season, day in and day out. It does not do things by halves, nor even by three-quarters, but by 100 per cent. plus. It set its hands to the plough years ago, and has never since looked back.

In membership, enthusiastic work and general progressiveness it has outdistanced every other commercial organization in the lighting field. It can always be said of its convention that it was "the biggest ever held." The coming convention will most assuredly be no exception to this rule. Every effort that could add to the inter-

est, value and enjoyment of the occasion has been made by the competent officials having the matter in charge.

There will be some who are connected with the electric lighting industry who will be prevented from attending by business and personal reasons and a few others who will not attend because—well, just because they have not quite the " git-up-and-git " to " git-out " of their beaten path. They will miss one of the great opportunities of the year for acquiring a new stock of that information and enthusiasm which is so necessary in the successful prosecution of any business.

Selling Light

The question of securing an equitable division of the advantages of the new high efficiency electric lamps is one that has not yet been settled. In most cases the central stations have accepted conditions as they are, and more or less cheerfully set themselves about making the best of things; and it is really surprising how little complaint and dissatisfaction has arisen in this country. Many a doleful sound comes from across the water as to the ruinous effect of the tungsten and modern electric lamps upon the central station revenue, but conditions in the electric lighting industry there are very different, judging from the tenor of the electrical press, from what they are in this country.

The education of the public up to the point of purchasing light rather than electricity is proceeding quietly but steadily with us. The substitution of the magnetite arc for the inclosed carbon arc is one of the factors in this education. The increase in illumination is so material and evident to the ordinary observer that the public is quite willing to pay a larger price for current when used with this light-source. After all is said and done, it is illumination that is wanted, and the only safe course for the central station to take is to educate the public along these lines as rapidly as can be done without encountering an undue amount of prejudice and opposition.

The most efficient electric lamps of today are great improvements in point of economy of current over those which they are supplanting, but they are a long way from being the limit of perfection in this respect. There is no telling when another lamp may make its appearance representing an equal advantage in economy. It is a self-evident proposition that another improvement over the best modern lamps equivalent to that of these lamps over their predecessors would bring about the positive necessity for central stations receiving a higher rate per kilowatt for current for lighting purposes. There is no need of expatiating upon the difficulties of raising prices; the present howl about the increased cost of living is sufficient proof. No matter what the conditions or circumstances may be that bring about an increase of price, those who must pay will object. The only sure way to avoid such objections in the case of light is for the public to get accustomed to paying for the thing which they really buy—namely, light—then when any further improvement in its production is made the cost can be reduced to a certain extent, and still leave a portion of the benefits to the producers.

Means of measuring illumination have been brought to a sufficient state of perfection to form a basis for cost, and it only remains for the users of light to be made familiar with the fundamental principles of illuminating engineering. Such a condition would not only obviate the serious question of the reduction in current occasioned by improvements in lamps but would insure a much better understanding between consumer and producer, and in the end conduce to equity and justice to both.

Illuminating Engineering in the Colleges

Gradually but surely the technical colleges are recognizing illuminating engineering by establishing courses of instruction in their regular curricula. We have just received the April bulletin of the Thomas S. Clarkson School of Technology, Potsdam, N. Y. In the description of the courses of instruction we find the following:

14. Illuminating Engineering.—Measurement of light; calculation of illumination; incandescent lamps; arc lamps; vapor lamps; reflectors, shades and globes; photometry;

lighting of offices, drafting room, public halls, libraries, corridors, theaters, stores, factories and residences. Prerequisite, Physics. 2. Lectures, recitations and problems. II.: F., 2 (1).

The abbreviations indicate that this course will occupy one hour on each Friday during the second semester of the year, and will count as one semester-hour in the general course of study.

This is the youngest of the technical schools of the State, having been established in 1896. Youth has advantages, even in the case of schools; there is less dead weight of tradition and precedent to carry, and a greater freedom and vigor in the selection of its courses of instruction. The Clarkson School is to be congratulated on the progressive spirit which it has shown in recognizing the youngest of the branches of engineering.

Death of Mr. C. J. Toerring

As we are about to go to press the sad announcement reaches us of the death of Mr. C. J. Toerring on April 22. Mr. Toerring was the designer and manufacturer of a line of electric arc lamps bearing his name, and was one of the pioneer inventors of the inclosed arc lamp.

A further description of his place in illuminating engineering will be given in our next issue.

Removal

On May 1 the offices of THE ILLUMINATING ENGINEER were moved to 15 West Thirty-eighth street. This location is " just around the corner " from their former quarters at 36 West Thirty-ninth street, and is equally accessible to the principal railway terminals, hotels, the New York Public Library, the United Engineering Societies Building and the central uptown business section. We invite all our patrons and their friends to make every possible use of our office facilities while in the city.

Notes and Comments

The movement for better street lighting shows no abatement in public interest in the land of its birth, which is to say that portion of the United States which we Easterners are in the habit of calling " the West," and which includes everything west of the Alleghany Mountains. While this division of the country is very unequal as to territory, it is far less so in regard to population. The East is not only thickly sprinkled with cities and towns, but a large number of these are of the first order. The fact is all the more striking, therefore, that the West has thus far so outstripped the East in this matter of public lighting. The record of the month does not show but a single Eastern city or town lining up in the march of progress.

It might be supposed that the Eastern cities were already well lighted and hence had no occasion to make radical changes, but this is a supposition contrary to fact. The truth of the matter is they are not as wideawake and progressive as the Western towns; they are running along on the track of fixed ideas, with a sense of their own self-sufficiency as the motive power.

It is time that even this conservatism, born of age and inherited wealth, should break through its shell and follow the example set by the younger and more thrifty municipalities of the West.

The following items are gleaned from the daily press and show how extensively the idea of good street lighting is taking possession of the Western part of the country:

HOUSTON, TEXAS.—Houston has a street lighting system that, as far as practical service is concerned, equals the best; but after the proposed rearrangement planned by City Electrician Clarence George is carried out the city will present a business district whose lighting system will be unsurpassed in point of beauty and service. Under plans drawn by this department, it is proposed that all unsightly wooden poles be removed from the fire limits, this to be accomplished as soon as the lighting company places their wires underground. This work is already well under way, $300,000 having been appropriated toward it.

When the light wires and poles are re-

moved from the streets the city is planning to place ornamental hollow iron poles at the four corners of each street and between each block on each side of a street. This will give about five times more light than at present, besides greatly beautifying the business district both in daytime and at night.

The iron poles are used by many of the larger cities of the country, having been found to be more practical for use with the underground system, with a wearing efficiency of 100 per cent. From a beauty standpoint, the old wooden poles with suspended arcs cannot be compared to the ornamental iron, and when installed along street fronts and corners changes the entire aspect of the district.—*Post.*

LINCOLN, NEB.—The Commercial Club committee which has had charge of securing subscriptions for lighting business streets by ornamental system has the proposed district almost signed up. It is thought that within a few days the committee will be ready to send in its order for the poles, the company agreeing to ship within 30 days from the time the order is received. Reports will be received this afternoon from members of the committee.

The proposition of getting business men to sign up for these poles has been easier than had been expected. Whereas it was intended at first to use only 200 poles, the signatures are almost all secured which will call for 280 poles.—*News.*

STOCKTON, CAL.—One of the finest advertisements a city can possibly have is a brilliant lighting system, especially in the business section of the city. The more extended the lighting system, the more businesslike appearance the town has, the more lasting and deeper impression a stranger gets of the place.

About the first thing a stranger notices about a city after dark is whether it is well or poorly lighted. Whatever impression he may receive in this regard he will always retain, and this will form his gauge of the city's progress—or lack of it.

For some months the Merchants' Association of Stockton, comprising about 200 of the leading business men and taxpayers of the city, has been working upon a proposition which contemplates the lighting of the business section of Stockton with several hundred light clusters—six to the block.

The plans contemplate an underground system, with ornamental standards and clustered, globed electric lights. It will in every way be up to date—an unmistakable mark of progress—something of which the people of the city may be proud.—*Mail.*

CEDAR RAPIDS, IA.—The boulevard lighting proposition is soon to be brought to the notice of the downtown property owners again. A committee of the Commercial Club has been working in conjunction with the management of the Electric Light Company and a property owners' committee, and revised contracts, satisfying both property owner and tenant, have been arranged.

The property owners as a rule are taking very kindly to the idea of boulevard lights, and members of the Commercial Club conversant with the situation predict that the entire business district will be fitted with these lights before the end of the summer, arranged in a beautiful and symmetrical plan.

Any one who has seen the business district of Des Moines or any of the other large cities which have installed the lights is struck with the beautiful and metropolitan effect caused by the long line of lights arranged along the curbs.—*Republican.*

SPRINGFIELD, MO.—Work was commenced yesterday on the installation of the new steel arches which are to supplement the original white way of Springfield on Commercial street.

Much enthusiasm and appreciation of the lights was found when the lighting committee of the Commercial Club, headed by R. L. Doling, entered upon the work of renewing the contracts for this year, and all but two of the merchants have signed for another year, and this is in addition to many new signers who failed to come in last year.—*Republican.*

MASON CITY, IA.—Cluster lights for Mason City may possibly be realized if a committee of 15 appointed by the Commercial Club succeed in interesting the business men. It is planned to put in these lights 82 ft. apart and at a cost of about $85 per light, with $2 per month additional for maintenance. Main street, from Fourth to Eighth, State for three blocks and Seventh street have been designated as places for these lights.—*Des Moines Register.*

DES MOINES, IA.—East Des Moines is to have some more electroliers. Last evening the property owners on East Fifth, between Walnut and Locust, signed up for the new street lights. The lights are the regular five-globe electroliers and are to be placed 60 ft. apart on both sides of East Fifth, between Locust and Walnut.—*Capital.*

LOCKPORT, N. Y.—The Lockport Light, Heat & Power Company submitted its proposition to the Common Council last night for the lighting of Main street and West avenue, by which it intends to inaugurate a new system of illumination of these streets according to more modern methods.

The new plan is to install 18 steel arches, 125 ft. apart, each to contain ten high efficiency lamps, with reflectors, of the same power utilized in the present 15 arc lights on these streets, and which it is proposed to supplant them with.

The company claims that the lights will give a greater illumination than the arc lights, a more attractive appearance to the business district than at present, and be more appre-

ciated by the citizens and business men.—*Union-Sun.*

ELGIN, ILL.—At the conference between Manager E. C. Faber of the Aurora, Elgin & Chicago Railroad Company and the lighting committee of the City Council, the magnetite type of arcs was decided upon. The chairman of the committee requested the company officials to take under consideration the proposition of removing all of the old style open arc lamps and replacing them with the new style of magnetite arc. The magnetite arc is being operated in the Fifth Ward and is found to work most successfully. There is less danger of its going out in case of high wind, also from any of the various reasons that the old style open arc does.

The advisability of removing all of the electric light towers of the city was also discussed at this meeting and is said to have met with favor.—*Courier.*

MOORHEAD, MINN.—The public spirit of Moorhead is asserting itself and Moorhead is to have a "Great White Way." With the making of "Great White Ways" in the larger cities there has been a sentiment among the most progressive citizens of Moorhead that this city should have a White Way and thus be one of the foremost cities in the Northwest to have one.

At a recent meeting of the City Council the matter was taken up and a committee of Aldermen Stanford, Kiefer and Pederson was appointed to take the matter up with the business men of the city.—*Fargo News, March* 26.

City Engineer A. M. Hopeman has been advertising for bids for 60 new street lampposts and will make his report to-night at the Council meeting. These lamps are for the "Great White Way" which the Commercial Club and the enterprising committee from the Council have under way.

The committee which has been getting the business men lined up for the new posts has had fine success, the citizens responding finely.—*Fargo News, April* 13.

DECATUR, ILL.—Mayor Borchers hopes that the fine showing made about the Powers block by the added street lamps will cause business men in other blocks in the downtown district to get busy and do something. We need a good deal more light in the business district in Decatur to keep at the head of the modern procession, and this ball has been started rolling by H. L. Oldham, manager of the Powers block.

The added lights make a great difference in the appearance of the block. They were turned on for the first time Friday night; they were admired that night by hundreds, and by thousands Saturday night. It struck everybody that it would be a fine thing to have lighting like that in all the business district.—*Review.*

PHILADELPHIA, PA.—With the signing of his name to an ordinance recently passed by Councils, Mayor Reyburn yesterday approved the location of 870 additional electric lights throughout the city, of which 506 will be on Market, Arch, Chestnut and Walnut streets. The new lights will make these streets as brilliant from river to river as Market street is now. They have been petitioned for by all the business men on those thoroughfares.—*Press.*

President Sheppard made an important announcement to the people of Frankford during the course of his remarks. He produced a diagram prepared by the Electrical Bureau, showing a new system of lighting in that section, and explained that the work is to be completed by September 1. The plan provides for the placing of additional lights every 150 ft. along Frankford avenue from Adams street to Oxford pike. The lights erected in the middle of blocks will be swung on an arm extending 10 ft. over the street, while the corner lights will be swung 15 ft. over the crossing.—*Record.*

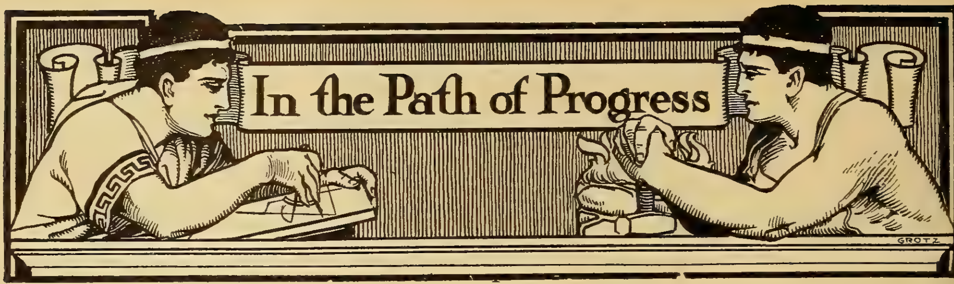
GEORGETOWN, CAL.—The carnival to be held here Friday for the purpose of raising a fund for the improvement of the streets and to provide more street lights promises to be the largest celebration held in Georgetown since the days when it was one of the big towns of the State.—*Sacramento Bee.*

LEAVENWORTH, KAN.—The city commissioners have been taken largely with the new tungsten light, it seems, in view of the fact that nearly every light they have installed recently is of that type. In some cases they have even replaced arc lights with tungsten.

Mayor O. M. Abernathy says that for every arc removed two of the others are put up. This plan has the obvious advantage of lighting a greater territory. Although the tungsten lights are not as powerful as arcs, Mayor Abernathy thinks, they are bright enough for suburbs. It is only in the outlying parts of town that tungsten lights have been substituted for arcs.—*Times.*

OAKLAND, CAL.—Through the suggestion of City Electrician George R. Babcock that the city might enjoy better and more economical lights by substituting gas lamps for the present arcs in use throughout the residence sections, the Board of Public Works has authorized him to draw up tentative plans and specifications touching upon this matter that the plan may be laid before the board in a detailed manner at the regular meeting in two weeks.

Babcock plans to install 12 gas lamps where one arc light is now used. These lights are to be placed 100 ft. apart, at a height between 12 and 15 ft. from the ground. In this manner the streets and sidewalks both would be illuminated from the light, while at present with the arc lights the sidewalks get little illumination.—*Tribune.*



Commercial Literature

The above expression very properly describes a class of printed matter which is peculiar to modern times. It is "commercial" in that its professed and direct purpose is to promote the sale and purchase of commodities, and it is properly called "literature" for the reason that it gives accurate information in regard to the particular wares which it exploits in as carefully chosen and expressive English as can be found in a majority of scientific and descriptive works. We are, of course, speaking of commercial literature in its best form. There are many crude productions that are neither literature nor commercial, in that the language is poor and the information vague or wanting.

It is not our policy to review in this department any commercial publications except those which have a direct bearing upon the science of illuminating engineering. It is a pleasure to note the rapidly increasing practice of giving useful engineering data in commercial literature dealing with lighting apparatus. Generally this data is of much wider application than to the particular apparatus advertised, and is entitled to a permanent place in the illuminating engineer's library. Among such publications we take pleasure in calling attention to the following:

WELSBACH ILLUMINATION DATA BOOK.

Under this title there has recently been issued from the Illuminating Engineering Laboratories of the Welsbach Company, Gloucester, N. J., the most complete and, in fact, the only book of engineering data pertaining to incandescent gas illumination. The book consists of a handsome leather cover arranged for the easy insertion and removal of the separate sheets on which the data are given, thus enabling obsolete matter to be taken out and new matter inserted, so as to keep the book always strictly up to date.

The first sheet contains instructions for plans and specifications. Following this is a table of foot-candle constants for different heights and distances from 16 to 24 feet. From this table the foot-candle of illumination on the horizontal plane can be obtained for any height and distance within the given limits by simply multiplying the candle-power at the given angle by the corresponding factor. A blue-printed diagram from which the angle corresponding to any given height and distance may be at once read off follows this table. There are then given photometric curves of all the different lamps fitted with standard accessories which are included in the Welsbach system.

It is noteworthy that their Reflexolier, which is a chandelier fitted with from two to four Reflex lamps, is included in this list. A diagram showing energy costs for equal illumination by all the different commercial light-sources concludes the book.

The book is published for gratuitous distribution to gas companies, and any company which fails to secure a copy and make constant use of it in the work of gas illumination is missing one of the greatest helps that has ever been offered for the promotion of better gas lighting.

MAZDA INCANDESCENT STREET LIGHTING.

The above is the title of Bulletin 7A issued by the engineering department of the National Electric Lamp Association, Cleveland. Like all bulletins issued from this source, it contains numerous useful tables, accurate engineering data and reliable information on the subject treated. Distribution curves of six different types of reflectors for street use are important features of this bulletin.

BENJAMIN MAZDA TUNGSTEN FIXTURES.

This is Bulletin No. 5 issued by the Benjamin Electric Manufacturing Company, Chicago. As the title indicates, this pamphlet illustrates and describes a large line of cluster fixtures especially designed for the use of tungsten lamps that are manufactured by this well-known house. Besides giving the dimensions and general descriptions, there are illumination curves given for typical fixtures.

PHOENIX QUALITY INVERTED GAS ILLUMINATION.

The above is the title of a pamphlet issued by the Phœnix Glass Company, New York, illustrating and describing its line of globes and reflectors designed for use with inverted gas lamps. The different designs are classified according to the particular use for which they are intended, and a short but really useful description of each class is given.

The illustrations are particularly good and a very welcome relief from the hopelessly flat and meaningless woodcuts which the glass shade makers have so long used.

The booklet is 6 x 9 in size, and shows a very commendable effort to use modern ideas of commercial literature in the description of this class of goods in place of the unwieldy and inartistic catalogues which have heretofore been a tradition among glass manufacturers.

PHOENIX QUALITY TUNGSTEN ILLUMINATION.

This is a booklet similar to the one above described, showing a number of their reflectors, which are particularly adapted to the tungsten lamp, and giving photometric curves and other useful data.

EFFICIENT SHOW WINDOW ILLUMINATION.

Under the above title the National X-Ray Reflector Company of Chicago has issued a 16-page pamphlet treating of this important special problem in illuminating engineering. Photometric curves of their different reflectors are given, with tables and rules for their proper use. Diagrams showing the intensity of the light in different directions by the use of lines whose distance apart is proportionate in intensity are a notable feature of the pamphlet.

CENTRAL STATION STIMULATION.

The above is the title of a pamphlet recently issued by the Central Station Development Company of Cleveland, Ohio. Price, $1.00, postpaid. A complete review will be given in our next issue.

Progress of the Flaming Arc Lamp

THE ILLUMINATING ENGINEER from the very beginning has exploited the peculiar merits of the flaming arc lamp for certain illumination problems. While very considerable skepticism was expressed in the lighting field when this revolutionary improvement first appeared in this country, the lamp soon won recognition on its merit. The following communication from the General Electric Company, Schenectady, N. Y., is of interest on this subject:

The first installation in the Northwest of 18-ampere flaming arc lamps was made in front of the National Guard Armory at Minneapolis, for service during the first annual electrical show held by the Northwestern Electrical Association, March 26 to April 2, 1910.

One of the difficult problems to be solved by the association was the illumination of the exterior of the armory and its grounds. After giving the matter due consideration as to the best methods of illumination, it was unanimously decided to install the new 18-ampere flame arc lamp manufactured by the General Electric Company.

As an experiment two of these lamps were placed at the top of a 50-foot pole, approximately 75 feet in front of the armory. Much to the surprise of those interested, these two lamps not only gave a brilliant golden light, sufficient to illuminate the entire building and street in front, but proved to be the best possible advertisement for the electrical show. As the lamps swung high in the air they resembled two miniature suns, attracting considerable attention for a great distance in all directions.

These 18-ampere lamps are similar in construction to the well-known 12-ampere lamp, but a slight change in the mechanism being required to adjust the lamps for operation at 18 amperes.

The illustration (on the front cover) is from a photograph taken at 9.30 P.M., but gives little idea of the remarkable brilliancy of this new lamp.

A New Lamp-post Factory

The Elmer P. Morris Company, 90 West street, New York City, manufacturers of lamp-posts and lighting specialties for exterior work, are erecting a large

factory at Elizabethtown, Pa. Upon its completion their present factory at Newark, N. J., is to be closed down.

Although the new factory has a capacity of several times that of the old one, it will take several months to complete orders on hand.

The Cooper Hewitt Electric Company Buys a New Factory

The Cooper Hewitt Electric Company has recently purchased a new building at Eighth and Grand streets, Hoboken, N. J., which they will use for the manufacture of their lamps as soon as it can be properly equipped with machinery and apparatus. Electrical power will be used, supplied by the Public Service Corporation of New Jersey.

The rapidly increasing demand for the Cooper Hewitt lamp has crowded their present facilities to the point of serious congestion for a year past, rendering a large extension of facilities an absolute necessity. The manufacture of their alternating current lamp will be first taken up in their new works, within a few weeks, as soon as sufficient machinery has been installed.

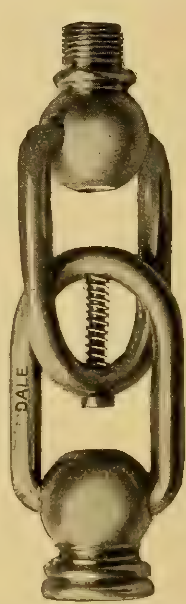
The Cooper Hewitt lamp has made comparatively little noise in the propaganda of revolutionary improvements in electric lighting that has attracted so much attention within the past three years, but has nevertheless maintained a steady and rapid growth based upon the merit of the lamp itself and the liberal and fair policies characterizing the management of the company.

I. P. Frink Will Soon Occupy a New Factory

This well known manufacturer of reflectors and special illuminating engineering appliances announces that the business will be moved into their new factory building at the corner of Tenth avenue and Twenty-fourth street about August 1. This is the natural outcome of the thorough and painstaking work which has always characterized the large line of reflectors put out by this manufacturer.

Another "Missing Link" Discovered

A number of devices have been put upon the market for interposing a spring between the tungsten lamp and the supporting fixture in order to prevent sudden jar from injuring the filament. Perhaps the cleverest of all of these is the one illustrated herewith, which is a combination of a chain link affording a universal motion to the lamp holder, thus allowing it to always hang in a vertical position and the requisite spring to take up vibration. The simplicity of this contrivance is certainly admirable. It is furnished either in the round link, as shown, or in a square link where square tubing is used in the fixture, and is manufactured by the Dale Company, New York.



DALE'S "MISSING LINK," COMBINED SHOCK ABSORBER AND ADAPTER FOR TUNGSTEN FIXTURES.

Proceedings of Technical Societies

PROCEEDINGS

DISCUSSION

The Illuminating Engineering Society

At the April 14, 1910, meeting of the New York section two papers were read. The first was on "Finite Surface Light Sources," by Bassett Jones, Jr. The second on "The Relation of Fixture Design to Modern Illuminating Engineering Practice," by L. R. Hopton and H. E. Watkins. As the title indicates, Mr. Jones's paper is a mathematical discussion of a purely technical subject. The formulæ worked out are of undoubted value to those accustomed to read on mathematics.

The paper by Mr. Hopton, the former illuminating engineer, the latter the chief designer of the Enos Company, well-known fixture manufacturers of this city, is of unusual interest not only from the high standing of the writers but because the paper on a similar subject by one of the same authors was presented before the society some three years ago.

The significance of the reception which this later paper received is commented on in this issue. The following extracts give the general tenor of the matter presented in the paper:

Were an outsider asked to define the relation of illuminating engineering to architecture, or, to be more concise, to define the relation of modern illuminating engineering to architectural principles, and were he to attempt to find his answer by searching the literature of our profession, he would be at a loss to shape his reply. Were he to attempt to narrow his definition to the relation of fixture design to modern illuminating engineering practice, he would still be unable to formulate a definite opinion. We are told by one writer,

"The great curse of the engineering profession is the inbred belief that efficiency is the only thing that counts."

And by another,

"The illuminating engineer must enforce the recognition of his figures and calculations, disregarding every other limitation but practicability, efficiency and economy."

We also read:

"The illuminating engineer who considers only the scientifically practical side of the profession is necessarily doomed to ultimate failure, for he will not be able to obtain the recognition that the importance of his work deserves."

And:

"Engineering has no essential connection with esthetics in any form; the sooner the illuminating engineer gets this out of his head the better."

Considering such diametrically opposed ideas as these, it seems almost hopeless to formulate a satisfactory definition that shall answer the implied question contained in the title of this paper. The various writers whom we have quoted are certainly honest in their beliefs, but they hold pronounced differences of opinion on what we consider to be a most important matter.

Our belief is that many of the differences of opinion among illuminating engineers regarding the proper design of lighting fixtures come from a misconception of the particular locations and uses of the fixtures in question. For some classes of lighting fixtures the illuminating engineer can carry his ideas of efficiency and construction as far as he wills. The fixture designer and architect will gladly modify their design so that the instrument of lighting will be, above all else, a scientifically designed engineering apparatus. The latest lamps and reflectors can be adopted without question, and the success or failure of the fixture may be measured largely by the illuminometer, wattmeter or any other meter that may be required to measure engineering results. In other cases the designs may be greatly modified by consideration of efficiency and economy, but this modification must be carried out intelligently by those who are ever closely in touch with the architectural limitations.

In still other cases the artistic qualities of the design must be uppermost. The fixtures must be in perfect architectural harmony with their surroundings, and nothing radically new in the way of lighting as affecting the design can properly be considered. These cases call for the greatest skill in conserving the period of the architecture and in

designing harmonious and appropriate lighting fixtures.

The development of the lighting structure affords a fascinating study—that is, the ornamental and structural development of lighting fixtures with relation to the means or appliances for lighting, the architectural period and various other considerations. As we study this history we find the same appliance for lighting handled in different ways and ornamented in different manners, and the quantity and quality of the light also altered to harmonize with the changing conditions of architecture.

We might generalize further, but to illustrate the matter more clearly we will briefly consider a few of the more distinct periods in architecture and the relations of fixture design and lighting methods to the various periods under consideration.

In speaking of the latest developments of fixtures for efficient illumination we might call attention to many peculiar and novel constructions. We might show fixtures designed solely for indirect illumination, we might show standards for libraries and reading tables, we might show fixtures designed for symbolic or spectacular effects, we might show fixtures in which the humble gas light has been wrought into pleasing and artistic form, and we might show even arc lights clothed in a covering that totally changes the ugly and ill-proportioned commercial casing into a structure of beauty and harmony. All of these are the solutions of every-day problems in which we have attempted to "combine science and art."

At the March meeting of the New England section the subject of store lighting was considered, gas illumination being presented by Benjamin T. Bean and electrical illumination by L. Brent Foster. A typical store was taken and lighting specifications with the two systems presented, practically the same intensity of illumination being provided in each case—namely, 4-ft. candles. Much interesting and valuable information was brought out in the discussion.

Light and Artificial Illumination, by G. H. Stickney; read before the Engineers' Society of Pennsylvania, November 8, 1909. *Journal of the Engineers' Society,* March 10.

Gives a brief treatment of the measurement of light and illumination, followed by a general discussion of electric lighting developed in the historical order of progress of the electric light.

Quality of Light, by Paul F. Bauder; Popular Science Lecture before the Franklin Institute, Philadelphia, November 12, 1909. *Journal of the Franklin Institute,* March, 1910.

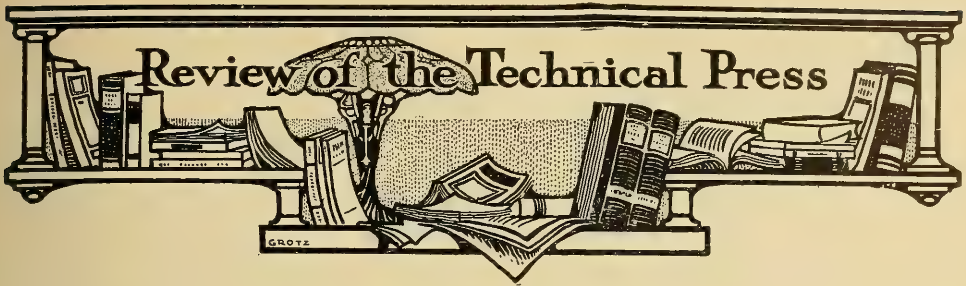
The author takes sunlight as the ideal illuminant and classifies the qualities which constitute this ideal as follows: Intensity, color value, direction of rays, ability to reveal detail and adaptability. Each of these qualities is then taken up and discussed with reference to artificial light, curves for the color values of different illuminants being given.

Electric Car Lighting, by J. R. Sloan; read before the Central Railway Club, Buffalo, N. Y., March 11; abstracted in *Electrical World and Western Electrician,* April 2 and 9.

Deals almost entirely with the generation of electric current.

Street Lighting for Small Cities, by J. R. Cravath; read before the Minnesota Electrical Association, Minneapolis, March 29.

The writer points out the advantages of the tungsten lamp for small cities that cannot afford an arc lamp placed at each street intersection.



American Items

NEW BOOKS

"Eye-Strain in Health and Disease," by Ambrose L. Ranney, A.M., M.D., 316 pp. Illustrated, cloth, $2.00 net. F. A. Davis & Co., Philadelphia, Pa.

Dr. Ranney's book cannot be called "new," strictly speaking, as it was published in 1897. As it is a medical work, however, and therefore unlikely to come to the notice of illuminating engineers through their ordinary channels of book buying, we feel entirely justified in giving it a review in this department.

The subject of eye-strain and its effect upon the general health is one which has enormously increased in importance since the publication of this book. While the author deals only with defects in the organs of vision as causes of eye-strain, there is no escaping the conclusion that the effect upon the nervous system as a whole must be precisely the same, whatever the cause of strain in the particular set of nerves concerned in the process of vision: any difference that may exist must be one of degree rather than of kind. Undoubtedly, eyes that are seriously defective optically or physiologically may give rise to more severe strain than would result from the misuse of normal visual organs through improper illumination; but the extreme severity of the results of eye-strain due to imperfect visual organs is an impressive argument as to the results that may be expected from the lesser strains from bad lighting.

Dr. Ranney's book may be read with the assurance that the writer is one fully competent to speak upon the subject. He is the author of standard works upon the nervous system, and has held responsible professorships on the same subject.

The following extracts from the first chapter state the importance of the subject in a manner both clear and convincing:

"To counteract the underlying factors of disease is even more important than to combat disease when actually developed.

"In endeavoring to present the view (now quite generally accepted) that the eyes themselves may (when defective in refraction or when imperfectly adjusted so that they fail to work in harmony with each other) constitute an important and too commonly neglected factor, both in causing and perpetuating disease, I believe and trust that I shall open to the minds of some of my readers a field worthy of serious thought and careful consideration.

"Within the past few years the attention of the medical profession has been drawn more forcibly than ever before to the fact that eye-strain may constitute an important element in the causation of all nervous disturbances of the so-called 'functional' type, and also of many symptoms referable to the viscera. The latter are too often construed as indications of actual disease of the organ disturbed.

"In the light shed upon this subject, chiefly by recent contributions to medical literature, the view is gradually being accepted by many in the profession that certain nervous diseases (whose pathology, to say the least, is still in doubt) are possibly not dependent, in every case, upon an unrecognized organic lesion; and they are being led to coincide with the statement that the term 'functional' nervous disease may be properly applied, in some instance at least, to the graver nervous conditions—such, for example, as epilepsy, chorea, hysteria or other manifestations of nervous exhaustion and insanity.

"In other words, the professional mind seems more willing now than in the past to discard an apparently fruitless search for a

pathognomonic lesion for each intractable nervous condition and to look more calmly upon tangible clinical facts, even if they are radically opposed to pre-existing views.

"The literature of medicine goes to prove conclusively that the duration of life is materially shortened by nervous debility and the disease which it entails. Any factor, therefore, in their causation ought not to be overlooked. This subject of inquiry has become invested with an importance which cannot well be ignored by searchers after truth.

"If the view that eye-strain is a frequent cause of functional nervous derangements proves to be the correct one beyond the possibility of a doubt or cavil, it is not difficult to see that a hope of marked relief or of ultimate recovery is practically extended to many hopeless sufferers upon whom drugs have exerted little or no benefit.

"Now is it at all inconsistent with physiological principles to advance the view that any excess of nervous expenditure to one organ over the normal amount which should be furnished is done at the expense of the others sooner or later?

"No one can draw incessantly upon his reserve-capital of nerve-force without incurring a risk of ultimately exhausting it. A bankruptcy in the reserve-capital of nerve-force entails untold ills to the individual.

"The day of reckoning is postponed in any given case in direct proportions to the drafts made upon the reserve and the amount of the reserve. This may help us to explain why some escape it definitely while others are precipitated into indescribable distress when life is hardly begun.

"Perhaps it has never occurred to most of my readers that sight is the only special sense which we use constantly, except during the hours of sleep. There is not a moment of the day when we are not acquiring visual impressions of some kind."

Chapter II. treats of "The Tests of Vision and Ocular Movements." The following six chapters treat at length of various diseases caused by eye-strain as exemplified by cases treated by the author. The seriousness of the diseases enumerated is appalling to the layman, among them being neuralgia, St. Vitus' dance, epilepsy and insanity. The two concluding chapters treat technically of the physiology of the eye.

The chief purpose of the author is to bring to the attention of the medical profession and the public the vital importance of giving attention to the eyes in order to avoid the extremely serious consequences which result from neglect to properly correct physical defects. There is no more inexplicable phenomenon in the general progress of science than the professional opposition which every important discovery in physiology and medicine has encountered. In a subject which deals so directly with the welfare of the human family it is almost inconceivable that any conscientious effort made toward improvement should receive anything but the most cordial and enthusiastic support and co-operation. Unfortunately, such has not been the case. The fanaticism of the Dark Ages, which opposed all progress alike, has lived longer in the medical profession than in any other division of science; and there seems almost as much opposition to-day to one being cured by any other means than those recognized by the profession as there was centuries ago.

Dr. Ranney has undoubtedly seen a decided change in the attitude of the profession toward the views expressed in his book some thirteen years ago. There is now an equally important task of establishing the evil effects of eye-strain from improper illumination, and impressing the facts with equal force upon the public. Especially should this be done with reference to the public schools. It is to be hoped that Dr. Ranney may find time and opportunity to push his investigations into this important field.

A VISUAL ACUITY TEST OBJECT, by Herbert E. Ives; *Electrical World*, April 14.

Describes experiments made with screens having fine opaque parallel lines ruled upon them and placed face to face so that the lines can be crossed at any desirable angle. Such crossing produces alternate light and dark bands, whose distance apart depends on the angle between the lines on the crossed plate. The article is valuable as giving a new and apparently better test for visual acuity than type faces that have been commonly used heretofore. In regard to test objects heretofore used, Mr. Ives says:

"Type of various sizes, such as used by the oculists for eye testing, is probably the least satisfactory as an exact measure of acuity. All letters of the same size are not equally distinct, so that their size is not a good measure of acuity. Further, a psychological element of recognition enters, different for different letters. For instance, if all the letters on a test card were turned through

90°, the acuity readings would be considerably changed for all except professional typesetters. Concentric circles are better in this respect; straight lines, whose inclination to the horizontal could be changed between readings, unknown to the observer, would be still better. The inherent defect of this type of test object, however, is that the observer can see the change being made in the illumination, which gives the memory a chance to prejudice the judgment. The only varying quantity should preferably be the size of the detail observed.

"Converging straight lines are imperfect, because the eye is assisted, by observing the lines separated in one part of the field of view, to separate them at another. Only by constructing the test object of quite prohibitive length could the lines be nearly enough parallel in the field of view to obviate this defect. The objection to changing the distance of the object is that visual accommodation is changed, again introducing the element of memory. Further, unless the object occupies only a small part of the field, or the field is uniformly filled at all distances with objects, the total flux of light coming to the eye is changed."

THEORETICAL NOTES ON INTERIOR LIGHTING, by W. E. Barrows; *Electrical Review and Western Electrician,* April 16.

The beginning of a series of articles, the nature of which is sufficiently indicated in the title.

PROFIT FROM INDUSTRIAL LIGHTING, by Frank B. Rae, Jr.; *Selling Electricity,* April.

Starting out with the statement that "the lighting of an industrial establishment is undesirable from the central station standpoint and expensive to the man who buys central station power," the writer shows how the evil may be lessened by the use of the most careful methods of illuminating engineering, concluding with the statement that "industrial lighting will probably never be profitable, but it can be made less unprofitable than is generally the case at present, and can be used as a lever to gain business instead of acting as a deterrent."

ILLUMINATION INTENSITIES AND QUALITIES FOR DEPARTMENT STORE LIGHTING, by A. J. Marshall; *Selling Electricity,* April.

The writer believes that better effects in store lighting would be obtained by adapting the intensity to the class of goods illuminated, and suggests that this might be accomplished by running tungsten lamps at other than their rated voltages.

THE EFFECT OF REGULATION ON INCANDESCENT LAMPS, by L. L. Elden; *National Electric Light Association Bulletin,* April.

Gives figures and curves showing the effect of voltage regulation above and below normal on current consumption, candle power and income, with carbon filament lamps.

MAKING A DAYLIGHT FACTORY, by C. A. Howe; *Factory,* April.

Describes the lighting installation in a shoe factory, eight candle power lamps with metal reflectors on drop cords being used.

THE LIGHTING OF "PERIOD" INTERIORS, by Basset Jones, Jr.; *American Architect,* March 30.

The article is illustrated with views of interiors in prominent historical buildings. The subject is treated in Mr. Jones's usual scientific and analytical manner, the esthetic side of the question being quite as scientifically treated as the engineering, as the following introductory paragraph shows:

"It seems perhaps unnecessary to repeat the truisms that art makes its appeal solely through the channels of sense—to what it appeals and why it appeals being, of course, another question, and that the perception of the esthetic ideal embodied in an architectural composition, depending, as it does on the visual sense, demands an appropriate and carefully studied relation of effects in light and shade. Reduced to its simplest terms, the sensuous aspect of beauty in architecture is a matter of the grouping of light values, excepting, perhaps, those purely spacial and geometric characters depending for their perception on eye parallax and other muscular reflexes; but even then the reflex is itself induced by the arrangement of the light stimulus."

THE MAZDA SERIES LAMP FOR STREET LIGHTING. by C. O. Brandeis; *Central Station,* April.

Valuable chiefly for the two tables of technical data on the tungsten lamp for street lighting.

Foreign Items

Compiled by J. S. Dow

ILLUMINATION AND PHOTOMETRY.

Proceedings of the Illuminating Engineering Society in London.

In previous numbers of this journal some reference has been made to the discussions of the Illuminating Engineering Society in Great Britain, and it may be well to preface this review with a word or two on the recent proceedings of the society. It is, of course, impossible to give any adequate idea of the discussions, the ground covered being very wide.

At the meeting on January 11 the subject of "Glare, Its Causes and Effects," was discussed (see the *Illuminating Engineer*, London, February, 1910; also *Illuminating Engineer of New York*, March, 1910). This discussion was subsequently resumed at the next meeting on February 15, and a full account of this addition is to be found in the *Illuminating Engineer* (London) for March. The same number also contains an account of the inaugural dinner of the society, which took place on February 10. The chief feature of interest in connection with this dinner was the participation of eminent representatives of the different professions interested in illumination who spoke on this occasion, and one and all expressed their good wishes for the success of the movement.

At the most recent meeting of the society on March 15 a discussion was opened on the "Measurement of Light and Illumination." A number of different aspects of photometry were referred to. The president opened the discussion by a summary of the aims of light-measurement, and showed, by aid of a series of large models, how the chief types of photometers were operated. Prof. Vernon Harcourt gave some account of his experiences of light house work. Dr. J. A. Fleming advocated the use of electric incandescent lamp standards, and emphasized the desirability of further researches into an incandescent standard of light. Mr. C. C. Paterson of the National Physical Laboratory, replied to Dr. Fleming's criticism of the Pentane standard, and exhibited some results showing the degree of agreement obtained in photometric readings. Mr. A. P. Trotter pointed out the deficiencies in the photometric equipment of many technical colleges and institutions. Dr. W. E. Sumpner and Prof. J. T. Morris dealt with polar curves of light distribution and the measurement of mean spherical candle power. Mr. J. S. Dow referred to some communications from corresponding members, including Dr. K. Stockhausen, Dr. Louis Bell and others. This discussion is to be continued at the next meeting.

Die Aufgaben der Beleuchtungskunst, by R. Bernoulli (*Z. f. B.*, March 20).

The author, as in the previous articles, proceeds to discuss the bearing of esthetic principles on problems of illumination. He points out that the choice of fixtures must be controlled by the nature of the interior. Certain rooms of a massive and splendid character, for example, reception rooms in palaces, require correspondingly heavy and massive fixtures.

The Distribution of Energy in the Spectra of Artificial Illuminants, by W. W. Coblentz (*Illum. Eng.*, London, March).

The author continues his examination into the quality of radiation from various sources from the standpoint of light production. In his last article he discussed the nature of the theoretical "black" and "gray" body. He now gives illustrations of the spectra of incandescent metals and oxides, etc.

Methode der Berechnung der Horizontalen Beleuchtung von Strassen und Platzen, by P. Högner (*E. T. Z.*, March 10, 17).

Discusses the best methods of working out the ground illumination given by a

source whose polar curve of light distribution is known, and gives a number of graphical constructions for this purpose. The author also suggests a method of comparing the illumination in streets lighted by similar means, based on a comparison of the maximum or mean illumination with the minimum.

THE USE OF THE FLICKER PHOTOMETER FOR DIFFERENTLY COLORED LIGHTS, by H. Airey Morris (*Journ. Inst. of Elec. Engineers,* London, February 14, 1910).

This paper has been referred to previously. The author investigates the flicker photometer, applying to it some theories of the rate of dying away of luminous impressions due to different kinds of light.

BLENDUNG, IHRE URSACHEN MUND WIRKUNG, by K. Stockhausen (*Z. f. B.,* February 21, 28, March 10).

Concludes an article on glare and its effects. See also his contribution on the same subject to the discussion of the Illuminating Engineering Society in London (*Illum. Eng.,* London, February and March).

ILLUMINATION, ITS DISTRIBUTION AND MEASUREMENT (*Continued*), by A. P. Trotter (*Illum. Eng.,* London, March).

In this section the author discusses the best plane of reference in measurements of illumination. He also explains the principle of Crova as applied to color photometry, and refers to the use of dyed screens for commercial work.

NATURAL AND ARTIFICIAL ILLUMINATION, by Prof. S. P. Thompson (*Second and Third Lectures delivered before the Royal Institution in London,* J. G. L., March 1 and 8).

These lectures are of a general nature and cover a great deal of ground. In the last of the series reference is made to the use of diffusing screens to distribute light and cut down intrinsic brilliancy. In conclusion the need for an illuminating engineering society in order to deal with practical problems such as factory and school light is insisted upon.

AN UTOPIAN SCHEME OF ILLUMINATION (*Illum. Eng.,* London, March).

Describes a curious scheme of lighting brought forward by an inventor in 1763. He proposed to light the city of London by means of a single powerful oil lamp, hung high up at the top of a tower and flanked with parabolic reflectors.

THE LIGHTING OF THE PATENT OFFICE LIBRARY (*Illum. Eng.,* London, March).

Describes some alterations in the lighting system of this important library in London. Hitherto the lighting of the tables was obtained only from chandeliers, which, however, were hung over the gangways, and did not give a satisfactory light. This arrangement has now been supplemented by local stand lamps on each table fitted with Holophane reflectors.

THE MEANING OF ILLUMINATING ENGINEERING (*Electrical Field,* March).

A general article explaining the need for the impartial and wide treatment of problems of illuminating engineering, and defining this term.

THE RATING OF LIGHT SOURCES (*J. G. L.*).

Discusses the desirability of comparing different sources of light in terms of their mean spherical candle power. The writer appears to think that, for practical purposes, the method is open to some objections and that the intensity of a lamp is often conveniently stated in terms of its maximum candle power.

ELECTRIC LIGHTING.

LARGE METALLIC FILAMENT LAMPS FOR STREET LIGHTING (Editorial; *Electrician,* March 11).

STREET LIGHTING IN WESTMINSTER (*Electrician,* March 11).

Comments upon the growing tendency in Great Britain to make use of metallic filament lamps for street lighting purposes.

RESEARCH ON METALLIC FILAMENT LAMPS, by F. H. R. Lavendar (*Jour. of the Institution of Elec. Engineers,* London, February, 1910).

The author describes a series of tests on

six different types of metallic filament lamps. They give very good results, many lamps burning for several thousand hours. The author seeks to draw conclusions regarding the "smashing point" of metallic filaments, *i.e.*, the point at which it pays to throw a lamp away. In the discussion, however, several speakers thought that the point was too uncertain and ill-defined to be much use as a guide in practice. In general, it did pay to throw away a carbon filament lamp as soon as it became appreciably black, but it was best to retain a metallic filament lamp, as a rule, until it burned out, as its useful life was usually determined by breakage and not by reduction in candle power.

THE MANUFACTURE OF METALLIC FILAMENT LAMPS, by J. Findlay (*Elec. Engineering*, March 10).

UEBER DIE NOTWENDIGKEIT DER EINFUHRUNG DER ELEKTRISCHEN BELEUCHTUNG IN DEN EISENBAHNWAGEN, by J. Seidener (*Elek. u. Masch.*, February 20).

THE PRESENT ASPECTS OF ELECTRIC LIGHTING (*Electrician*, March 11).

DIE VERBINDUNG DER FADEN MIT DEN ZULEITUNGEN UND UNTEREINANDER (*Z. f. B.*, February 28, March 10, 20).

DIE VERBILLIGUNG DER METALLFADENLAMPEN (*E. T. Z.*, March 3, 10).

Refers to the steady cheapening in metallic filament lamps and anticipates yet further progress in this direction.

GAS, OIL, ACETYLENE LIGHTING, ETC.

MAGNESIARINGE UND IHRE INDUSTRIE, by Dr. C. R. Böhm (*J. f. G.*, February 26).

DIE ENTWICKLUNG DER EISENBAHNBELEUCHTUNG, by A. Görger (*J. f. G.*, February 26).

AUFZUGSVORRICHTUNGEN UND KANDELABER FUR GROSSE HOCHHANGENDE GASLAMPEN, by G. Himmel *J. f. G.*, February 26).

UEBER DIE VERWENDUNG VON HANGELICHT IN STRASSENLATERNEN, by Luber (*J. f. G.*, February 19).

EXPERIMENTAL HIGH PRESSURE GAS LAMPS IN THE CITY OF LONDON (*J. G. L.*, March 1).

The first two articles named above deal with fixtures for powerful high pressure incandescent gas lamps, especially the new raising and lowering arrangements for use in the streets. The last note refers to several lamps provided with apparatus of this kind, which are now being tested in London.

SOME DIFFICULTIES ENCOUNTERED IN THE CLASSIFICATION OF ILLUMINATING PETROLEUM, by A. Guiselin (*Illum. Eng.*, London, March).

The author describes a series of tests on different qualities of petroleum. The chief point elucidated by these researches seems to be that it is impossible to compare different qualities without specifying very carefully the type of burner adopted and the exact conditions of the test. A variety of oil which is superior to another with a certain burner may be just the opposite when a different type of burner is employed.

THE NON-COLLODIONIZED MANTLE, by P. G. Somerville (*G. W.*, March 5; *J. G. L.*, March 12).

The author points out the merits of the type of mantle referred to. It is cheap and, being in a pliable condition, lends itself well to packing; the loss in transport is stated to be less than 2 per cent.

THE LUCAS INVERTED LAMP (*G. W.*, March 5; *J. G. L.*, March 8).

HIGH PRESSURE INCANDESCENT GAS LIGHTING FOR MILLS (*J. G. L.*, March 8).

LES ECLAIRAGES DE SECOURS (*Rev. des Eclairages*, February 15).

Refers to the inconvenience caused during the recent floods in Paris by the electric and gas light being out of order, and suggests that the police would do well to institute a system of portable acetylene lighting as an emergency system.

Contractions used:
E. T. Z. *Elektrotechnische Zeitschrift.*
Elek. u. Masch. *Elektrotechnik und Maschinenbau.*
G. W. *Gas World.*
J. G. L. *Journal of Gaslighting.*
J. f. G. *Journal für Gasbeleuchtung, etc.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The Illuminating Engineer

Vol. V JUNE, 1910 No. 4

UP FROM DARKNESS

We are told that in the beginning darkness was over the face of the deep. From the time that the light of nature spread its beneficent rays over the universe until man began to dispel the darkness by artificial light was a period which the finite human mind cannot measure; and from the beginning of man's use of light as a servant under his own dominion to the present luminants that literally vie with the sun in their brilliancy is another stretch of time measurable by millenniums.

Great as have been the improvements in the domain of artificial light within the past century, and after the lapse of the three incomprehensively long periods of development mentioned, we are yet an immensely long distance from the final goal. In our best modern light sources not more than 10 per cent. of the energy becomes luminous rays, and even such light as is produced is far from fulfilling the highest ideals of perfection.

But we need not dwell upon eternities and perfections in order to find an incentive and opportunity for immediately effective improvements. The fact is that in the use of such illuminants as we have at the present time we are at least 90 per cent. imperfect. Who will undertake to show that one installation in ten is the best that could be produced under the conditions? Carelessness, errors, false theories, and ill-considered practices are to be found on every hand. Great as is the work already accomplished, the work to be done is far greater. The production and use of artificial light is but yet in the pioneer stage. "We see through a glass, darkly."

When we have come to a complete understanding of the proper use of every illuminant, and every device for utilizing its rays; when we have discarded all that which is merely salable, and replaced it with that which is as near as possible perfect, we may then look forward more confidently to the full realization of the possibilities of light production.

Let there be more light, and let the light that we already have be better used.

E. L. Elliott.

FIG. I.—SOUTH MERIDIAN STREET, INDIANAPOLIS, FROM SOLDIERS' AND SAILORS' MONUMENT.

Seeing Indianapolis by Night

By Charles L. Eshleman and D. F. Fradette.

We do not want our readers to infer from the subject of this article that they will be treated to a vivid description of the many features attending an evening spent in general city sight seeing.

There are many interesting things to be seen nights in the modern and progressive city, but limited space will only permit our calling attention to the most technical, the most conspicuous and at present, the most popular idol in the eyes of the good people of Indianapolis—" Her Ornamental Lighting System."

In attempting to describe a representative ornamental lighting installation we selected Indianapolis not only because it possesses to our mind the most modern and comprehensive system of lighting standards but because the problems attending the consummation of this project will be met and must be solved by hundreds of other cities during their climb up the ladder to the well-lighted class.

INDIANAPOLIS—THE CITY OF LIGHT

Many cities in their eagerness to refer to a " Great White Way " have paid particular attention to the illumination of one particular street and have neglected others equally as prominent in the business affairs of the city. Where all attention has been focused on one thoroughfare, the tendency has been to overdo the lighting at that particular point; in some cases approaching a gaudy and vulgar display. It is poor policy to spend all the money on one street. Let us strike the happy medium and give our neighbor on the side

streets an opportunity to shine. His store on the cross street might be smaller, but he is a part of the business neighborhood and must have a square deal. In Indianapolis the entire business section is within the lighted area and a uniform intensity prevails throughout. It is ten times more desirable to say Indianapolis, "The City of Light," than Indianapolis' "Great White Way." Please bear this homely statement in mind when considering the installation of an ornamental lighting system. "All is not gold that glitters, and the tinsel of the Great White Way will soon be dulled." Light up and keep lighted up; but be sane; don't overdo it.

We wish to call particular attention to the illustration on the front cover, "A Mile of Lights." This is indeed a remarkable photograph, and will appeal strongly to all those interested in good illumination. Notice the even distribution of light and absence of shadows. This view, taken at 10.30 p.m. on a dark night, is surely a masterpiece in illumination and photography.

Fig. 1 shows lighting on South Meridian street. Four months ago this thoroughfare was enveloped in stygian darkness, and public safety was only conserved by vigilant patrol service. Policemen are now unnecessary.

This photograph was taken under most adverse circumstances on account of hundreds of automobiles and street cars passing in front of the camera.

CAMPAIGN FOR THE SALE OF ORNAMENTAL LIGHTING STANDARDS

The general adoption of high efficiency lighting units has not only revolutionized indoor and outdoor lighting methods but has created a new field—ornamental standard lighting.

It is only during the past year that this form of lighting has been advanced from the sale of so many pounds of cast iron to the sale of so much illumination. This scientific development is due to the cooperation of energetic central station lighting companies throughout the country with manufacturers of lighting standards and high efficiency incandescent lamps.

With most electrical development it becomes necessary to educate the current, using public to a full appreciation of the benefits to be derived before the specialty becomes popular. As a result of this consideration, the preliminary exploitation by the manufacturers and central stations covers a considerable period of time and is quite expensive.

Standard lighting differs from the above, in that it immediately appealed to the business interests throughout the country, and, in turn, the aggressive central station managers have taken hold in a manner little less than amazing to the manufacturer. Ornamental standard lighting presents itself as a good central station propositon, for the reason that the load is continuous for longer periods than any other connected current user, and further, that maintenance is quite low.

The public popularity may be attributed to four causes:

1. The important part that an ornamental lighting system plays in the popular movement for the city beautiful.
2. The advertising value to the city as a whole—an indication of its prosperous condition and progressive spirit.
3. The benefits in dollars and cents accruing to the business interests in the lighting district.
4. The increase in downtown property values and the decrease in crime.

INDIANAPOLIS CAMPAIGN.

Without further generalizing, we will outline the ornamental lighting campaign instituted by the Merchants' Heat & Light Company, Indianapolis. This campaign was born of a popular cry for a better lighted business section. Scheme after scheme had been proposed by the city, and also by outside companies. Nearly every system of lighting had been investigated, but it remained for the Merchants' Heat & Light Company to make the only proposition that would be considered by the public. After deciding upon the system to be installed, the real work of soliciting was begun by the circulating of petitions among merchants and property owners in the business section of the city. Co-incident with the circulation of petitions the company installed a complete stock of 12 standards. (Although not always necessary, it is quite desirable that the central station install a few sample standards for the inspection by the city authorities, merchants' committees and other interested

parties. The sample installation and preliminary work serves several purposes:

(a) Attracts merchants' attention,

(b) Gets them interested,

(c) Makes them feel that they want to buy, and at this point the central station contract manager should become active and

(d) Persuade them to buy.

Immediately after the erection of the 12 standards business men from all sections of the so-called downtown district called on the Merchants' Heat & Light Company, questioning how they could obtain the same results. A record was kept of all those who called or evinced special interest in the improved lighting, and when the company wished to sign up a block of merchants they sent a representative of their contract department to call on interested parties. This representative explained the proposition that the central station had to offer and, at the same time, endeavored to impress upon the merchants that co-operation was necessary to carry the project forward efficiently. This merchant was asked to serve as chairman of the block committee and to call on his neighbors and induce them to help light up their block. In most cases the committee secured about 75 per cent. of the signatures. The remaining signatures were secured by a special representative of the company, whose duty it was to start these companies and later line up those who had not signed on account of vacant buildings, absent proprietors, etc. On streets where merchants had formed associations of their own volition, meetings were called at which a representative of the company would be present and explain all details of the lighting proposition. Four different associations, each representing about three blocks, held meetings, and before adjournment had secured all signatures. In addition to this assistance from the merchants the Commercial Club indorsed the central station proposal and kept the newspapers posted. The City Council also indorsed the scheme.

FIG. 2.—WEST WASHINGTON STREET.

It should be remarked that the Merchants' Heat & Light Company before soliciting contracts made drawings, showing location of standard, name of property owner, his front footage and the amount of his yearly assessment. One dollar and five cents per front foot per year was the price charged the merchants for the service, and covers all expenditures to which the lighting company is subjected—first cost of standards, installation, cost of current, maintenance, etc. The following contract was used by the Merchants' Heat & Light Company:

CONTRACT FOR ORNAMENTAL STREET LIGHTING.

AGREEMENT, Entered into this....day of ....19.., between the MERCHANTS' HEAT & LIGHT COMPANY, hereinafter called the Company, and.............................. hereinafter called the Consumer, both of Indianapolis, Marion County, State of Indiana.

The Company agrees to install and operate a system of ornamental street lighting to consist of ornamental Pressed Steel poles, each equipped with five one-hundred watt-tungsten lamps, poles to be placed at equal intervals of eighty-four feet on both sides of the street. The Company further agrees to maintain said poles during the life of this contract.

The Consumer agrees to pay for such service $1.05 per foot front or a total of.................(.....) per year as......proportionate share, based on a frontage of......feet. Payment to be made to the Company on or before five days from date of bill rendered. The bills shall be rendered in twelve equal monthly installments.

The hours of service of said ornamental street lighting shall be from dusk to 12.00 p.m. during the life of this contract.

In event the Company shall not secure sufficient similar contracts to cover the square in which the Consumer's property is located to warrant the establishment of the system of lights herein provided for within six months from the date hereof, the Company may at its option cancel this agreement.

This contract shall be for a term of five years, beginning ...., 19.., and ending ...., 19...

This contract, although signed by an agent of the Company, is subject to the approval of the general manager, and shall not be binding on the Company until indorsed with his approval.

It is finally agreed that all the terms and stipulations heretofore made or agreed to by the parties in relation to said street lighting service are merged in this contract, and that no previous or contemporaneous representations or agreements made by the Company's officers or agents, shall be binding upon the Company, except as and to the extent herein contained.

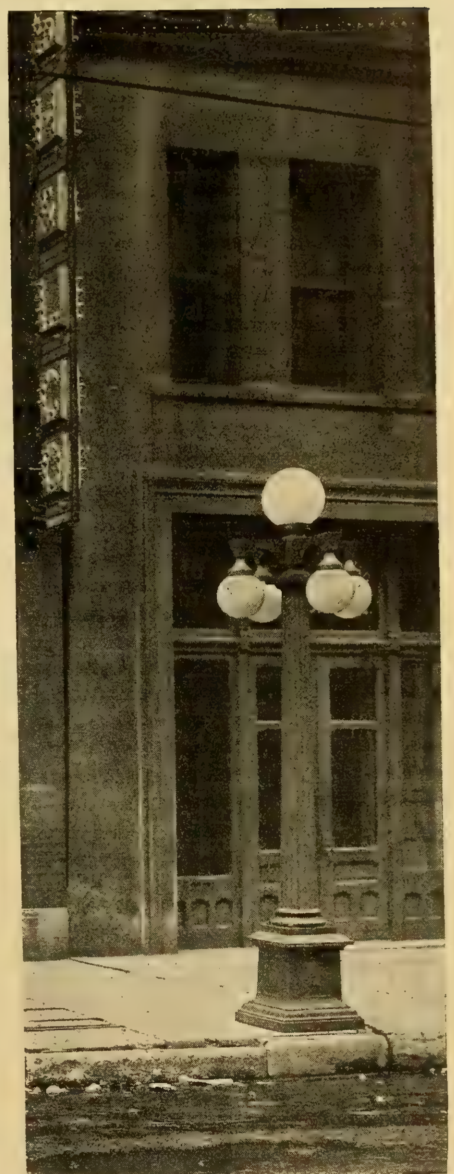


FIG. 3.—TYPE OF ORNAMENTAL STANDARD.

....

....

....

....

MERCHANTS' HEAT & LIGHT COMPANY.

By .... Agent.

.... Consumer.

By ....
Approved..............., 19..

....
General Manager.
MERCHANTS' HEAT & LIGHT COMPANY.

Local conditions vary so greatly that other methods of procedure are often necessary. The writers of this article have prepared a new form of contract which they believe will apply more generally than any heretofore used.

The central station is the logical interest to handle ornamental lighting propositions, because they know exactly what charge per unit or per foot front they should make to give good service and make a profit.

Be careful to keep this business out of politics.

ENGINEERING.

The system consists of several hundred No. 5 five-light standards, each equipped with five 100-watt tungsten lamps, inclosed within special diffusing globes; top globe, 16 in.; four lower globes, 12 in. in diameter. Standards are placed 84 ft. apart on both sides of the street. Lamps burn from dusk to 12 p.m. every night in the year. The company maintains the standards, painting, renewals and patrol service. The charge per foot front is $1.05 per year, and is paid by the ground floor tenant.

Connections are made through a 4-in. tile set 1 ft. under the gutter and 1 ft. from the curb, through which is run a three-wire lead-covered cable. The double throw switch is located in a corner standard and controls one entire block. This double throw switch and three wire system permits of four lamps being turned off at 12 p.m., leaving the top lamp burn all night. Wires heavy enough to permit of flat rate window and sign lighting on the same circuit should be used.

CONSTRUCTION.—The lighting standards selected by the Merchants Heat & Light Company are made of pressed steel and represent a unique and interesting development in ornamental street lighting specialties. This patented invention makes the construction of a tapered, fluted column or support from sheet metal a possibility for the first time, and lends itself admirably to the manufacture of lamp standards requiring classical lines and clean-cut, graceful contours. A sheet of steel of sufficient gauge to insure perfect strength is formed into a plain tapered column of proper architectural proportions. Another plain column of same size and shape, constructed of special non-oxidizing steel, is forced inside of the first. By means of patented machinery the double tapered column is then fluted in accordance with either the Doric or Corinthian orders of architecture. The double thickness of material, together with fluting, increases by several times both compression and lateral strength. Double thickness No. 22 gauge high carbon, non-oxidizing steel is employed in the manufacture of these standards. This construction carries with it sufficient strength for all purposes,

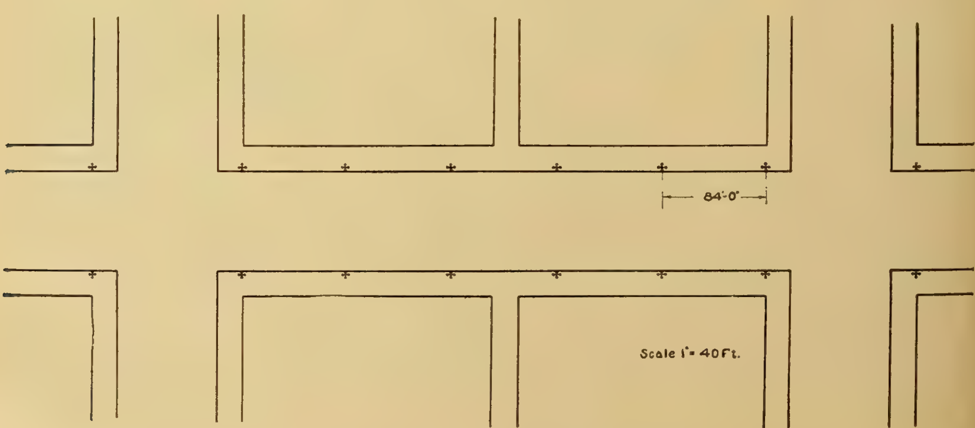


FIG. 4.—LOCATION AND SPACING OF STANDARDS.

yet does away with heavy shipping charges and great weight and difficulty in erecting standards.

Central Station Opportunity.—"Opportunity knocks once at every man's door." It is now knocking loud and clear at the doors of central stations. It is the public clamoring for better public lighting. Not since the advent of the electric light has there been such an opportunity for the central station to win public favor and increased patronage at the same time. Ornamental lighting standards combine to the highest degree those elements of art and utility which satisfy the most pronounced ideas of municipal progress.

Such an installation reflects credit upon the city, pleases the people, increases business and begets a desire to improve the general lighting of the entire town. The opportunity is here, the means of making it golden are within easy reach. Don't neglect it.

Railroad Illuminating Engineering

III.—Engine House Lighting.

By Harold Kirschberg.

As in a chain, which is no stronger than its weakest link, so also on a railroad the failure of any one of a great number of operations may result in a very serious disablement of motive power, with its consequent tie-up of traffic and loss of revenue. A failure of anything upon which such operation may result is only entailing more difficulty in maintaining the operation of the road, while not providing a total failure of any work. While all possible precautions are taken, such drawbacks however are themselves to be avoided as much as posible, being perhaps but the proverbial horse shoe nail in a series of consequent failures.

Not the least among such links in the chain of successful railroading is the lighting employed to enable the continuance of work during hours of darkness or of insufficient natural light. The number of conditions to be met in the lighting of any one of the various locations on a railroad, and the satisfactory solution of that particular problem, are measured to a great extent by the relative importance of the work done at that point and the part it plays in the reliable operation of the road. It is undoubtedly true that the maintenance of motive power equipment in good condition is as necessary to a railroad as is any other work done on its lines. For that reason it is absolutely necesary that the engine houses be continually in condition to receive locomotives for examination and repair, and furnish same ready for service at any time.

The engine house bears the same relation to a railroad that the stable does to the delivery system of an express company. All engines, after completing their runs, return to the engine house for cleaning and light repairs. The accompanying sketch shows a representative engine house. In the centre open space is a turntable which enables the shifting of a locomotive on to any track in the house. Inside the house are a number of tracks, each equipped with a pit, and some with a movable table. As the engines are run into the house, the pilot end is foremost. It will therefore be seen that the conditions to be met in the lighting of such a building are as follows:

1st. Light in the centre of the house and around the turntable. This is a clear open space.

2nd. Light in the engine house proper to furnish illumination

(a) on top of the engine.
(b) in the engine cab.
(c) on the front of the engine.
(d) below the running board.
(e) in the pit to facilitate repairs under the engine.

The foregoing conditions must be satisfied for every track and every engine; while the distribution of light should be such that a man working around the engine will not be in his own light.

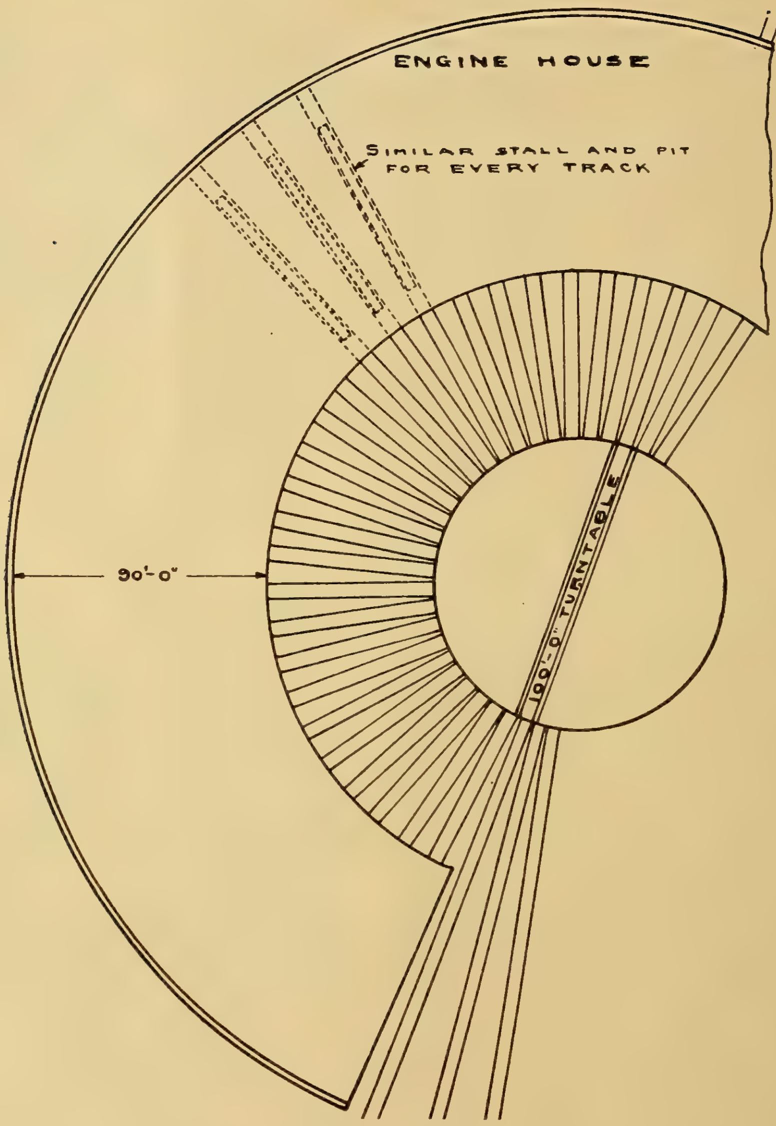


FIG. I.—TYPICAL ENGINE HOUSE LAYOUT.

Precautions against the action of corrosive gases must be taken to prevent short life and unreliable service from any lamp that may be used for the installation. It is apparent that all stalls are not in service continually. The division of circuits should therefore be as great as possible to affect a saving whenever and wherever possible. The use of a series system of lighting is therefore out of the question.

In a consideration of the spacing and height of lamps the dimensions of the largest engines handled should enter as a determining factor. The maximum length of the largest engine over all is about 79 feet, the tender occupying about 30 feet of that length. The top of the stack is about 15 feet above the rail top, the height to the top of the boiler casing being 13½ feet. From the top of the rail to the running board is from 6½ feet to 8 feet. The height to girders in the building is about 18 feet, distance between locomotives vary-

ing from 5 feet at the cab end to 10 feet at the pilot end. By reason of the great amount of smoke, oil and dust present, the lamps will require constant cleaning in order to keep the installation up to maximum efficiency. The latter item is therefore one of importance and should be included in the expense of up-keep.

As stated in a former article on "Railroad Illuminating Engineering," the most successful layout must also meet the requirements of low initial and maintenance cost. The only justification illuminating engineering has for attempting the solution of the foregoing problem is its ability to provide sufficient illumination with the lowest cost. The use of portable lamps is to be discouraged as much as possible, for the reasons that not only are they essentially low efficiency lamps, but they prevent the workman from using both hands to work with, or necessitate the presence of a helper to hold the lamp while at the same time creating a fire or electrical hazard due to the presence of cord wire around the engine. As in all railroad electrical work, the electrical conditions vary with the locality. The choice of installation may therefore be further constrained.

The author offers the foregoing merely as a subject of thought and does not enter into a solution through the use of any particular type of illuminant.

"Alternating Illumination"

By Nelson M. Black, M. D.

Mr. Albert Jackson Marshall, in the March, 1910, issue of The Illuminating Engineer in a short paper under the above title, makes a suggestion which may be decidedly beneficial in reducing "eye tire" from artificial illumination in these days when intense illumination is demanded.

His conclusion from a considerable number of observations of persons who have for various periods of time been subjected to the effect of different kinds of indirect lighting or where similar general illumination prevailed, has been "that a great deal of 'eye tire,' drowsiness and other evidences of discomfort could be eliminated if the eye were exercised, so to speak, and the waste matter which is constantly accumulating thrown off."

Mr. Marshall states that "all those who have conscientiously and broadly studied the subject of the effect of light on the eye are of the opinion that the eye, when compelled to operate in a space uniformly illuminated and where, owing to the lack of different degrees of illumination, shadows, and color effects, is unable to exercise itself, it will naturally, sooner or later, find the muscles incapable of satisfactorily performing their functions, partly owing to lack of usage.

"The thought has occurred to me that if it were possible to exercise the muscles of the eye involuntarily when the eye is endeavoring to work under such conditions as previously referred to, invaluable services would be rendered. While I have as yet not had the opportunity of actually trying out this theory I am led to believe that from a purely theoretical viewpoint, the idea has some value, and I therefore am prompted to give it publicity, trusting that some person or persons may be in a position to experiment with it and see to what extent it possesses value.

"The following experiment might lead to interesting conclusions: In a room where a uniform illumination of 2-ft. candles is obtained on a horizontal plane equal to the average height of the eyes of persons while in a sitting position, attach to the lighting circuit a dimming device which would vary the illumination intensity, say, from 1-ft. candle to 2-ft. candles, by exceedingly minute steps throughout a period of fifteen minutes, so that the eye by adjusting itself to this varying intensity of illumination would exercise itself without the brain being conscious of such action, and observe whether this 'internal massage' assists in maintaining the elasticity of the muscles of the eye and in elimination of 'eye tire' and headaches which so often result when persons are

compelled to say any great length of time in a room too uniformly illuminated."

We all know what an apparent relief is observed by rubbing the eyes after continued use in reading under artificial illumination, and how we do it almost involuntarily. This massage of the ball clears out the blood vessels and lymph channels with their waste products and allows a fresh supply of blood and lymph to take its place; the eyes feel refreshed and we go on reading with comfort.

Referring to Mr. Marshall's suggested experiment the test types used by me are engraved upon porcelain and are transillumined. The electric current passes through a rheostat, with which the intensity of illumination may be controlled at will. I have very often tried changing the intensity of illumination during an examination (especially when it has taken a considerable length of time) with the eyes under the effect of a cycloplegic and without; and found almost invariably that the individual would express relief when the intensity would be reduced and say, "Oh, that is better!" and then upon increasing the intensity again, would remark, "No, that is better!"

The explanation which suggested itself was: that exhaustion of the visual purple caused the tiring and that the reduction in intensity of illumination gave a chance for its renewal at least with the eyes under the effects of a cycloplegic when action of the ciliary body was paralyzed.

Mr. Marshall's suggestions along this line are certainly pertinent to the question of the effect upon the eyes of the demand for increased illumination. Another factor to be considered also is the effect of the color values in artificial illumination.

The New Street Lighting in Des Moines Iowa

It is always a satisfaction to see a public improvement that adds both beauty and utility to a city. But such public improvements do not come of themselves like the leaves in spring; wherever they appear it is evidence that some man, or body of men, have set themselves seriously at the task of accomplishing the purpose. The manner and method of securing an installation of modern lighting will therefore be of general interest as showing how men of public spirit and push go about the task of bettering their city, as well as give valuable pointers to those who may wish to inaugurate such a movement in their own town.

Mr. P. B. Sawyer, general manager of the Des Moines Electric Company, has kindly furnished us with a history of the splendid street lighting recently installed in Iowa's capital city.

"In the summer of 1908 the Commercial Club of this city took up the question of ornamental street lighting and appointed a sub-committee of that body with authority to act and look into the matter. This sub-committee obtained various designs of posts for both gas and electric service from the local gas company and ourselves, together with bids covering the installation of the posts and the price of service from dusk until midnight every night. We were successful in obtaining this work, acting as contractors for the installation of the poles, and then contracted directly with the merchants for the lighting. This committee of the Commercial Club succeeded in having an ordinance passed by the city permitting the erection of these posts, and also requiring that they be spaced in a uniform manner and as follows: Beginning at a point on the curb opposite the property line at street intersections, the posts were to be spaced along the street at 56 feet intervals. This spacing made six posts on each side of the street to the block. The same Commercial Club committee then appointed in each business block a committee of three business men in that block to solicit from the property owners contracts covering the erection of the posts, as well as contracts with the tenants for the lighting of the posts. These contracts, although solicited in this manner, were made direct with us and we installed the posts complete for lighting, with the exception of the five 100-watt tungsten lamps for $85 per post, net, which is practically the cost of the installation.

FIG. I.—NIGHT VIEW, WALNUT STREET, DES MOINES, IOWA, LOOKING WEST, SHOWING EFFECT OF NEW STREET LIGHTING.

FIG. 2.—WALNUT STREET, SHOWING ARTISTIC EFFECT OF ELECTROLIERS BY DAY.

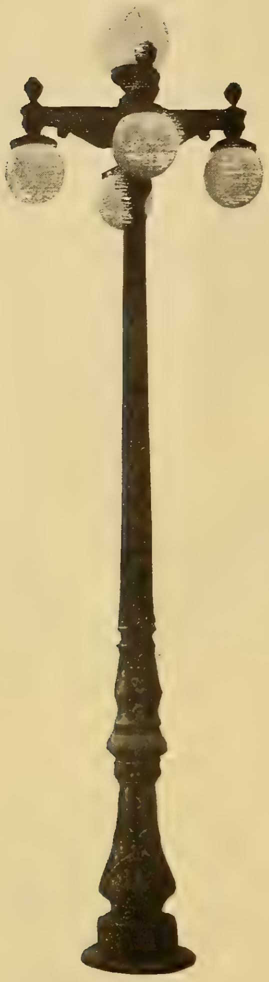


FIG. 3.—TYPE OF ORNAMENTAL LAMP STANDARD.

"The lighting contracts covered the furnishing of the first installation of lamps, together with free renewals and renewals of enclosing globes, together with ordinary maintenance of posts, as long as the lighting contract was in force, and turning on and off of the light, all of which service is included in the price of $69.50 per post per annum. Both of these contracts were signed by the property owners and tenants for the proportion that their frontage bore o the total frontage covered by the post or in the case where we combined all twelve posts in one block and made one contract for the entire block, the amount signed for covered the proportion of their frontage to the entire frontage of the block.

"We have been installing these posts since that date to the present time and now have some 260 in service, and expect to take on quite a few more this year."

Mr. Mack Olsen, chairman of the Commercial Club Lighting Committee, contributes the following interesting and valuable opinions from prominent citizens, showing how good street lighting repays in cold dollars and cents:

"Electrolier street lighting has a dollar and cents value to the property owner and to the tenant, in addition to the advertising value to the city at large and the altruistic value. Mr. W. L. White says that he is intensely interested in our street lighting and that in his opinion the system has added 25 per cent. to the value of the property on Walnut street, and is worth at least a thousand dollars a year to him in the increased business that it has created. Mr. Nate Frankel says that he has not figured the cash value of the system to him, but he thinks so much of the system that he insists on having the posts in front of every piece of business property he owns, and includes in his leases a clause that the tenant must pay for their maintenance. It is an axiom that people follow the light, and values of retail property are based on the number of people that pass the property daily. Therefore anything that will cause more people to pass a given point determines its rental value, and consequently its value. Mr. Lafe Young, Jr., says that the dollar and cents value is great and has the posts in front of all his business property. The fact that he has rented a corner in his building at Seventh and Walnut streets, 44 x 132, for $10,000 a year for ten years, shows what adequate street lighting will do. That our lighting has such value is demonstrated by the eagerness of property owners on connecting and parallel streets to put in the posts, as it proves its value on every street on which it is placed, and the other streets must put it in or lose trade, and consequent loss of value in the property. Our experience in this regard is borne out by every city that has installed a system of electrolier street lighting."

Hospital Lighting

I

The lighting of hospitals divides itself rather distinctly into several divisions, as follows: Wards and rooms, operating pavilions, hallways, and general utility rooms.

In the lighting of a ward the general intensity of illumination at the level of the beds, about twenty-four inches from the floor, the position of the light-sources, the color of the walls and ceiling, and the provision for special illumination must all be considered. For the general illumination the intensity should undoubtedly be sufficient to give a sense of illumination rather than a general gloom, while at the same time not being sufficient to tire the eyes or give a feeling of brilliancy. Such an illumination will range from one-fourth to one-half foot-candle.

As to the best method of securing such general illumination opinions of illuminating engineers will doubtless differ. Many will be inclined to recommend indirect illumination. This is secured by using reflectors under the light-sources in such a manner as to hide them entirely from direct vision and throw the light on the ceiling, from which it is distributed by diffused reflection throughout the room. Such an illumination is theoretically as nearly perfect as can be produced by artificial light. There is no glare from visible light-sources, the distribution is absolutely uniform, and there are no sharp shadows. Objections have been raised, however, to such light on the ground that it is wearisome both to the eyes and to the nerves. There is unquestionably a

FIG. I.—WARD WITH INDIRECT LIGHTING. THE LARGE INVERTED BOWLS OF OPAL GLASS REFLECT LIGHT TO THE CEILING, AND ARE MILDLY LUMINOUS. CARE MUST BE TAKEN TO PREVENT TOO GREAT INTENSITY IN THE SMALL SURFACE AREA ABOVE THE FIXTURE.

FIG. 2.—DIRECT ILLUMINATION BY BRACKETS. THIS HAS THE VERY SERIOUS OBJECTION THAT THE PATIENTS ON BOTH SIDES HAVE BRILLIANT LIGHTS DIRECTLY IN THEIR EYES. A WORSE INSTALLATION COULD HARDLY BE DEVISED.

measure of truth in this objection, especially when attempts are made to secure a high degree of intensity. Where only a moderate intensity is required, however, indirect lighting is certainly a method to be carefully considered. For the sake of efficiency it is customary to have the ceiling pure white where indirect illumination is used, and it is possible that this cold, dazzling white is responsible for most of the objection against the method. By giving the ceiling a yellowish tint this uncomfortable effect would be largely removed.

Another requisite in indirect lighting is that the ceiling should have, as nearly as possible, a uniform intensity. This will require a careful calculation along illuminating engineering lines. As every room will present a special case, and as it is the purpose of this paper to point out general requirements rather than engineering formalities, the method for such calculation will be omitted. In any case it is a problem which should be handled by a skilled illuminating engineer if the most satisfactory results are to be obtained.

In most cases lighting from a cornice round the side walls will not be satisfactory without the additional use of central chandeliers, the latter, of course, provided with inverted reflectors.

If direct lighting is to be used, and the usual arrangement of beds prevails—that is, a double row with an aisle through the center of the room—a row of central chandeliers is the only feasible method. The one necessary precaution is then to fit each lamp with a diffusing globe that will entirely hide the form of lamp filament. Fairly dense opal glass is the only means of securing such diffusion. This, of course, absorbs a large portion of the light—at least a half. Even so it is nearly as efficient as indirect lighting, and there

is no other way out of the difficulty. To leave bare gas or electric lamps in such a position that they can shine in the patients' eyes is a condition which cannot possibly be condoned on any grounds.

In buildings already in service, and in congested portions of the city where light is scarce, physical conditions will often interfere with the best arrangement of beds and lights; but where the location is such as to offer the opportunity the ideal arrangement is to provide narrow wards containing single rows of beds, with windows between and the artificial lights on brackets over the head of the bed.

The color and character of the wall finishes may properly be considered under the head of illumination. The first rule to be observed is to avoid all finishes that have the slightest gloss. Both walls and ceiling, as well as tables and other articles of furniture, should have as nearly as possible a perfectly mat or dead surface. Bright spots from direct reflection are an annoyance to be carefully avoided.

As to color, the importance of the psychological effect is a serious matter. As considerable attention has been given to investigations along this line by physiologists and psychologists, it need not be argued here. The fact has been established that different colors produce distinct and positive effects upon the mental condition and nervous system. These vary from the exciting effect of red at one end of the spectrum to the depressing effect of violet at the other. The intermediate parts in the yellow and green give rest and contentment. A buff or cream colored ceiling with light yellowish green for side walls would perhaps furnish the ideal combination, although buff, which is yellow containing a slight amount of red, is very satisfactory. While set patterns or

FIG. 3.—WARD IN CHILDREN'S HOSPITAL, ILLUMINATED BY COMBINATION GAS AND ELECTRIC BRACKETS. THE BARE ELECTRIC LAMPS ARE HIGHLY OBJECTIONABLE, ALTHOUGH THE FAULT IS MINIMIZED BY THEIR POSITIONS ON THE SIDE WALLS; THOSE ON THE CEILING ARE NOTHING LESS THAN INSTRUMENTS OF TORTURE.

FIG. 4.—WARD IN MATERNITY HOSPITAL. FORTUNATELY THE EYES OF THE INFANTS CAN BE PROTECTED BY CLOTH THROWN OVER THE CRIBS. THE CEILING FIXTURE IS ATROCIOUS, WITH ITS BARE LAMPS.

figured decorations are, of course, out of the question, it is advantageous to give a rough finish to walls so as to give an effect of texture rather than a dead, flat surface. This can be accomplished by giving the plaster a sand coating, or by covering the walls with buckram or some fabric of coarse weave which can then be tinted with water or mat surface paints. It may be objected that such surfaces offer lodging places for disease germs, but this is not the case if the proper kind of paint is used. It is possible to obtain varnishes which are practically non-porous, which at the same time give a mat surface.

For providing special illumination to patients for reading, or which may be required by the nurses from time to time, a small electric lamp properly screened by a reflector and attached to the head of the bed affords a perfectly satisfactory solution of the problem. Fixtures for this special purpose are regularly manufactured and sold by dealers in electrical fittings. An eight candle-power lamp, frosted at the end, will furnish the correct amount of light.

In the private rooms the general requirements are the same, but are much easier to fulfill by reason of the conditions of the room itself. A very useful arrangement in these cases is the bed lamp as described fitted with what is known as a " turn-down " electric lamp. This is a lamp having two filaments in the same bulb, the one giving the regular candle-power—about 16—and the other one two candle-power. The pull of a cord switches the lamp from one filament to the other. It would, of course, be still better to install such a lamp on a regular bracket on the wall at the head of the bed.

A portable or table lamp is preferable to a chandelier. Such a lamp can easily be provided with a shade, which while keeping the direct light out of the eyes of the patient will give a general illumina-

tion in the room; and there is an effect of coziness about a table lamp that is entirely wanting with the chandelier.

The lighting of hallways is a very simple matter, an intensity of one-half foot-candle on the floor being a good average to work to. It is advisable to screen all lights with some sort of diffusing globe.

The lighting of an operating pavilion is manifestly an important and serious problem. The intensity on the operating table should not be less than ten foot-candles, and fifteen to twenty-five is more often found in actual use. To secure this a large number of ordinary electric lamps, clustered under a large reflector made up of sections of opal glass, has been the device most often used, and is doubtless still the prevailing method. In order to get the maximum illumination these clusters are generally placed just above the heads of the operators. As a result the heat produced is largely reflected as well as the light, and is often well nigh intolerable.

In one of the largest and oldest of the New York hospitals a room with shower baths has been fitted up next to the operating pavilion, so that the surgeons can cool off after their labor under this excessive but wholly unnecessary heat.

The necessity for the light being absolutely steady and free from any possibility of going out, of course, precludes the use of all forms of arc lamp. Improvements in electric lamps and reflectors within the past three years have happily entirely removed the necessity for these cumbersome and furnace-like lighting fixtures.

The tungsten lamp gives three times the amount of light for a given amount of current than is given by the familiar type of carbon filament lamp. This means, of course, that there is only one-third as much heat generated for a given amount of light. While it would be possible to furnish sufficient illumination with a single high candle-power tungsten lamp in a suitable reflector, it would not be advisable on account of the possibility

FIG. 5.—PRIVATE ROOM. THE BRACKET AT THE HEAD OF THE BED IS WELL PLACED, BOTH FOR CONVENIENCE AND RESULTING ILLUMINATION. IT SHOULD BE FITTED WITH A DIFFUSING GLOBE, WHICH WOULD ENTIRELY COVER THE LAMP.

FIG. 6.—NURSES' ROOM. THE CEILING FIXTURE IS HIGHLY OBJECTIONABLE, GIVING A GLARING LIGHT FROM A HIGH ANGLE, WHICH IS EXCESSIVELY IRRITATING TO THE EYES.

of the lamps suddenly going out by the breakage of the filament. This one contingency would be entirely avoided by the use of a cluster of four smaller units under a single reflector. The number of sixteen candle-power incandescents used in the old arrangement was usually about twenty, which represented over 1100 watts of current. The four tungsten lamps take sixty watts of current each and would afford ample illumination, giving 240 watts, or less than one-fourth. The illumination would easily equal that usually furnished by the common arrangement by reason of the better design of the reflector.

The tungsten lamp also has the advantage of giving a considerably whiter light than the carbon filament lamp; and this brings us to the consideration of the color of light for the operating table. This should undoubtedly be as nearly as possible an equivalent to daylight, since the color of tissues and organs is commonly observed under natural light and their conditions judged accordingly. Intensity of illumination, however, has much to do with color observation; if it is sufficiently intense, as it invariably will need to be for this purpose, there will not be sufficient discrepancy between the artificial light and daylight to give any trouble. Small hand lamps on a flexible cord should be provided for special illumination when required. In most cases very little general illumination will be required. This can usually be furnished by lamps on side brackets furnished with dense opal shades, or it may be supplied by indirect illumination.

Where electricity is not available and city gas is to be had, the lamp known as the inverted gas arc would furnish an equally satisfactory illumination, although, of course, the production of heat would be greater. A special reflector should be provided in such cases.

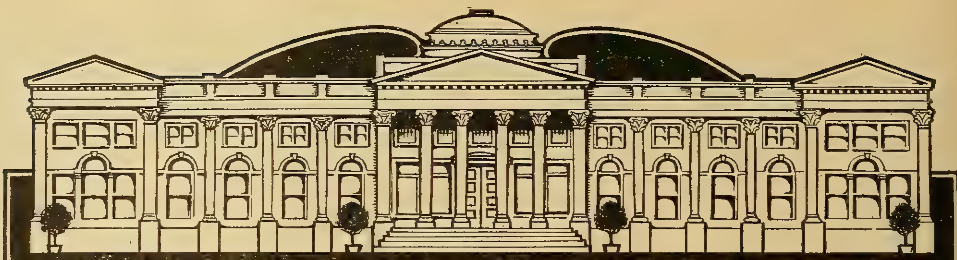
The power of the ultra-violet and other

visible rays to destroy bacteria is fraught with great possibilities. Among these is the use of a light-source which will at the same time give the necessary radiations to keep the atmosphere and exposed tissues absolutely sterile during an operation. It is by no means impossible that the so-called quartz lamp, which is a mercury vapor lamp with a quartz tube, may afford the means to this end. The surgeon and the illuminating engineer are bound to touch elbows in the very near future.

The lighting of general utility rooms includes offices and physicians' quarters, servants' rooms, etc. The problems are, therefore, the same as for general purposes in schools, offices or other buildings, and the same general principles can be laid down. First and foremost, it should be an inflexible rule never to use a modern light-source, either electric or gas, without some form of diffusing reflector or shade. The dazzling effect of modern light light-sources is always dangerous and should never be tolerated.

Where reading or writing is to be done, from two to four foot-candles should be provided. For work requiring especially close eye work, five to fifteen foot-candles may be required, according if the surfaces worked upon are of light or dark color. For general illumination from one to one and one-half foot-candles of light is sufficient.

FIG. 7.—OPERATING ROOM, WITH A COMMON FORM OF LIGHTING FIXTURE. THE LARGE NUMBER OF LAMPS GIVE AN EXCESSIVE HEAT AND GLARE.



Studies of Notable Installations

The Light of the Immortals

In the mind of the public every act and incident connected with a hero partakes of the heroic. What he eats and drinks, wherewithal he is clothed, what books he reads and by what kind of light he reads them, all share in the halo of glory which surrounds the immortally great or famous.

In the last issue of this magazine we had the privilege of taking a peep into the residence of the inventor whose name stands at the head in the field of electric lighting, and of seeing how he made use of his invention in his own residence. If we were privileged to step into a single

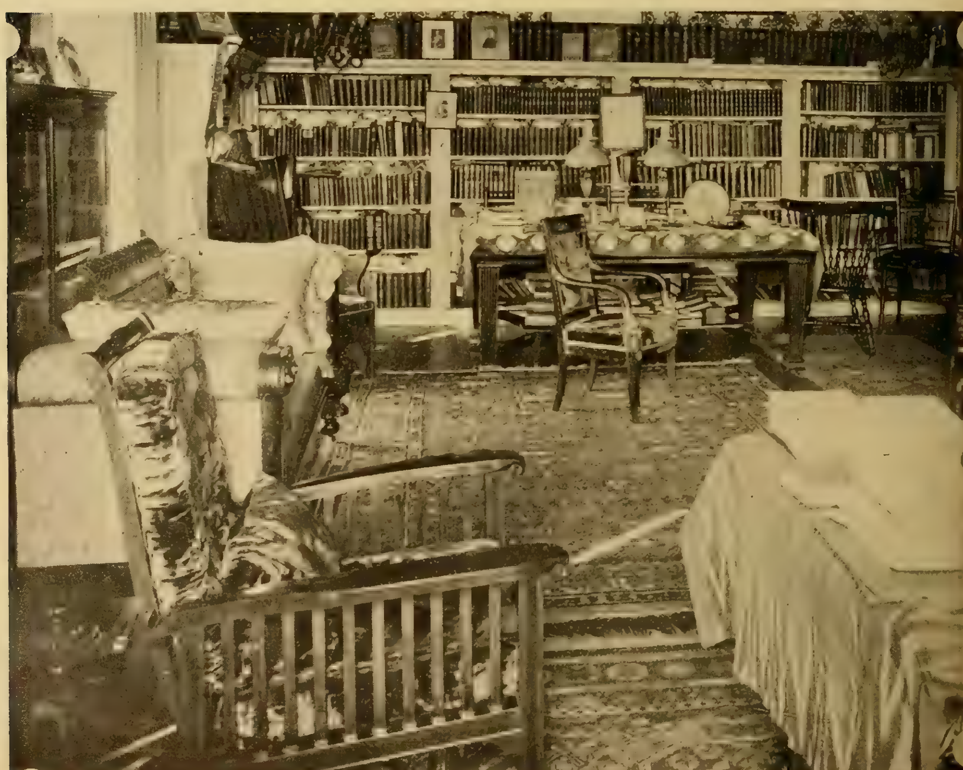


FIG. I.—LIBRARY AT HOME OF THEODORE ROOSEVELT, OYSTER BAY, N. Y.

Copyright by Underwood & Underwood, N. Y.

FIG. 2.—PRIVATE LIBRARY, HOME OF ANDREW CARNEGIE, NEW YORK.

room in the mansion of the great iron-master and philanthropist, Carnegie, our choice would unquestionably be his library. To see the private library of the man who is responsible for the existence of more public libraries throughout the world than any other individual in history, cannot fail to arouse unusual curiosity and interest. A view showing a section of Mr. Carnegie's library in his Fifth avenue residence is shown in Fig. 2. So far as illumination goes it is exceedingly commonplace, and easily excelled in hundreds of libraries of modest professional men and others whose names are unknown to the public. There is a central chandelier, which has no particular merit or demerit, fitted with apparently perfectly plain opal stalactite globes. In addition to these there are occasional three-light clusters of frosted lamps attached to the ceiling. The motto which holds the place of honor over the mantel is one to delight the illuminating engineer's heart: *"Let there be light."* The only misgiving which this suggests is that it should not have a physical fulfillment in this beautiful library, as well as only an allegorical meaning.

Whatever else may be said of Theodore Roosevelt, whether blame or praise, there is no denying the fact that he is a genuine hero; for it is as much a characteristic of

Copyright by Underwood & Underwood, N. Y.

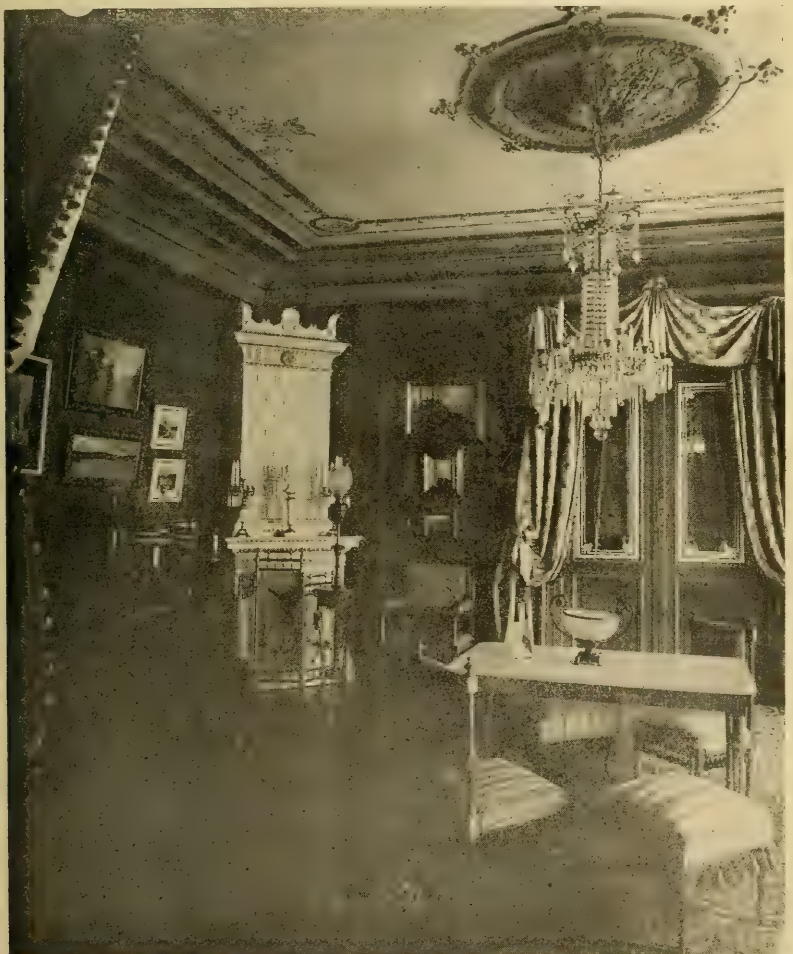
FIG. 3.—DINING ROOM IN PRESIDENT'S MANSION, CHAPULTEPEC, MEXICO.

the hero to be well hated as to be well beloved, and the ex-President has certainly received both these tributes in no small measure. His home-coming gives additional interest to all incidents connected with his private life. If all the renown of Mr. Roosevelt in the field of politics could be obliterated he would still occupy an enviable position as a writer. The library of his residence in Oyster Bay, Long Island, is shown in Fig. 1. We have here what many still claim to be the best of all possible illuminants for reading, the student lamp burning kerosene oil. Gas brackets are supplied at the top of the book shelves, and for pattern and general arrangement so inartistic that the only explanation of their existence must be that they are seldom used. There are ample evidences that in this library the books exist for the sake of their contents rather than as furniture.

Let us now step across the borders and make a brief call upon the president of our neighbor republic, Mexico. In Fig. 3 we have a view of the dining-room in the Castle of Chapultepec, the official residence of Mexico's ruler. There are many

indications of the lavish ornamentation which has come down from the Orient by way of Spain. The central lighting fixture is in keeping with this florid style of decoration. The candle is the ostensible light-source, being well simulated by miniature incandescent lamps, while gas jets are likewise at hand. The illumination is both decorative and efficient.

We will now journey across seas to the land of our remote ancestors. Norway still retains the vigor and enthusiasm that has been so influential, even in the diluted form in which it has reached the modern Anglo-Saxon race. Its writers, dramatists, poets and statesmen are still red-blooded, virile men, who do things worth doing in their own individual way. Of the generation passing away none will hold a more prominent place in Norwegian literature than Ibsen. The drawing-room of his home in Christiania is shown in Fig. 4. We meet here the primitive light-source in its actual form. The central chandelier is a candle bearer, in fact. While the use of crystal glass is common to other countries there is a distinct Norse character to this particular fixture. A modern kerosene lamp upon a tall standard also does duty as an illuminant.



Copyright by Underwood & Underwood, N. Y.
FIG. 4.—RECEPTION ROOM, HOME OF HENRIK IBSEN.

Fixtures and Accessories

The Use of Stained Glass for Shades and Reflectors

The enjoyment of color is one of the most universal of esthetic instincts. While its infinitely varied phases manifested in nature and the painter's art appeal to the highest development of this sense, there is an enjoyment in the contemplation of simple patches of color for their own sake. This is not unlike the pleasing effect of certain individual sounds. This enjoyment of color for its own sake reaches its highest state when the colors are seen by transmitted light. The most exquisite color effects in nature are utterly beyond the ability of the painter to represent on canvas, for the simple reason that they possess to a greater or less extent the quality of transparency. The blue of the sky, the green of the sea, and the gorgeous coloring of the sunset and the autumn forest absolutely defy reproduction on an opaque surface.

FIG. 2.

FIG. I.

The art of glass painting and setting has always held a high place in pictorial art. Although it is limited by numerous mechanical and technical difficulties, this field of art nevertheless offers opportuni-

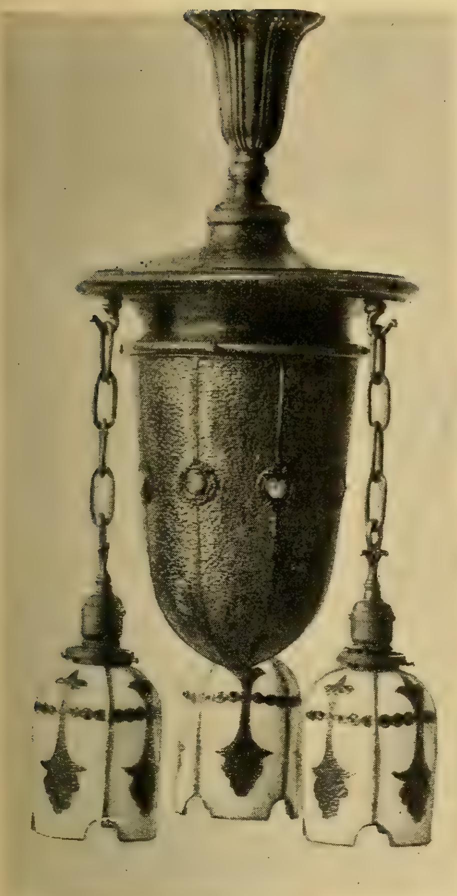


FIG. 3.

ties for effects both impressive and beautiful. Even if nothing more definite is attempted than to furnish a feast for the color sense, the results are worth obtaining.

The peculiar beauty of stained glass was confined to uses where it could be illuminated by natural light until very recent times, when modern light-sources, with their brilliancy and volume of rays, made it possible with artificial illumination.

Colored and painted glass is available for use in the construction of globes and shades for artificial light, either where a brilliant illumination is not desirable, or where special lighting is required for only a small space underneath the lamp. These conditions generally maintain in dining-rooms and "dens." It is, of course, impossible to give an adequate idea of stained glass without the use of color. The illustrations, however, will give some idea of the effects produced by the combination of artistic metal work with modern stained glass.

Fig. 1 shows a dome fixture, in which the metal work is designed along the lines of hand wrought designs. The panes of glass have a rough, irregular surface on the outside, and are hand painted on the inside, the painting of course being fired by the usual process. A result of the translucency of the glass in connection with the rough exterior surface produces a particularly soft and pleasing effect of color.

Fig. 2 is a crown fixture of simple but artistic design, supporting four small reflectors having Art Nouveau tendencies in their decoration. In this fixture efficiency is not the first object sought, although the shades serve the purpose of reflectors to a certain extent.

Fig. 3 is a fixture of unusual design. It would be quite suitable for a "den," where the rich coloring of the central bowl with its setting of colored gems would give the touch of gorgeousness generally desired in such cases.

Fig. 4 is a table lamp having a well designed shade of richly painted glass of the same order. In this case the leading effect

FIG. 4.

commonly used is secured by painting on the sections of glass. This method affords a much less expensive way of securing the colored effects of leaded glass, and thus to a large extent removing the chief obstacle in the way of more popular use of stained glass in connection with artificial lighting.

The Aristocracy of Art

In speaking of that most ancient and universal form of hero, the king, Carlyle traces the word to the same origin from which we have our word " can." The king is the man who *can,* the *able* man, the " man who does things," as we say in modern parlance. The man of deeds and power will always be a ruler in his own right; and a class of individuals who, by natural gifts and cultivated talents, excel in some particular field of human thought or activity, will form an aristocracy by the only " divine right " ever possessed by man—initiative and originality.

Aristocracy is literally the " rule of the best." Mediocrity always excels in numbers, and may sometimes by sheer brute force overthrow the democracy of ability; but sooner or later the best will prevail. We shall not have seen the last of aristocracies until mankind has either risen as a whole to a plane of uniform excellence or descended to a dead level of stupidity.

If genuine ability and excellence is not at hand, pretenders will be worshipped as heroes. The best is so by comparison, and may intrinsically be of little worth; and so an aristocracy may become in fact a rule of the commonplace or worse.

Among the various natural aristocracies perhaps none has more jealously or avowedly claimed the distinction of divine inheritance than that of art; perhaps also with much right and justice. Doubtless, also, no aristocracy has ever contained more pretenders and false prophets.

It is difficult to say which is the more curious phenomenon, the blind admiration of the ignorant for the imaginary glamour in which they behold the works of the incompetent or the Olympian superiority which the pretender always assumes. Let a man become possessed of the notion that he is an artist, and forthwith he plumes himself for flight; and having soared above the common herd upon the wings of his self-assurance, the groundlings gaze upon him with uplifted eyes in awed silence.

To speak more directly, there is nothing of which the fixture trade in this country stands so much in need at the present time as a really competent aristocracy of art. The aristocracy of true ability is never timid nor obsequious; it has no need to be. That which is best, if it be inherently good, exists and rules by its own power.

There is not in the entire fixture trade to-day a single designer of popular repute. Ask any individual who is not especially interested in the subject, or has had some special reason for looking up the matter of fixture design, to name the three best fixture designers in this country to-day and he will be absolutely at a loss to give the name of even one. Yet the designer of lighting fixtures at the present time, with all the diversity of light-sources and accessories, and the importance of artificial illumination in modern building, certainly offers an opportunity for personal distinction equal to that afforded by the design of furniture; and any reasonably well informed person would certainly recall one or two names among this class of artisans. Neither Chippendale nor Sheritan produced any artistic results which, for inherent genius, excel those that could be achieved in the construction of lighting fixtures.

This unfortunate condition in fixture manufacture is not wholly, or perhaps largely, due to the fact that there are no designers of real power and originality. A greater cause is the failure of the manufacturer to recognize the importance of personality. No matter how expensive or elaborate the fixture, or how important the building for which it is made, it goes out like a waif and a foundling, without bearing the slightest mark or trace of its

parentage. It is not stamped with the personality of an individual, but is simply the unnamed product of a factory. Is it any wonder that the fear of imitation terrorizes the entire guild of fixture makers? So long as there is absolutely no means of distinguishing between the original and real, and the imitation, why should not the public buy the imitation if they can secure it cheaper? Place two chairs side by side, indistinguishable in design, workmanship and finish; let one be a Chippendale of undisputed authenticity, the other a modern imitation; what will be the difference in value? Certainly more than ten to one in favor of the original; and similar illustrations could be drawn from almost all branches of artisanship.

Why should there not be a fixture designer whose name by reason of the excellence of his work should not carry equal weight? Who wants an imitation of Tiffany glass? Some do, and are able to buy it at a fraction of the price of the real. So of the Bacarrat glass in France; their ware sells absolutely upon the reputation which attaches to this name, at prices from 30 per cent. to 50 per cent. higher than similar wares of unknown make; and they have never attempted to protect their designs by any artificial methods, as those of patent-right.

There is no conceivable reason why a lighting fixture in which art is a distinctive element should not bear the name of both its designer and maker. Neither is there any sufficient reason why the designer should be always an anonymous character. A book publisher advertises the name of the illustrator and author; oftentimes a considerable part of the value depending upon the reputation of the former. Why should not the value of a fixture depend at least as much upon the name of its designer.

Among the fixture trade itself there is but a single instance in which the name of the maker is looked upon with the degree of respect which should maintain among a real aristocracy of art—and in this particular case the awe is out of all proportion to the merit; in fact, the case would be ridiculous if it were not pathetic.

The real cure for the curse of imitation which is so afflicting some of the fixture manufacturers of to-day is to be found in two directions; first, the creation of a really competent and worthy aristocracy of designers; and, second, the education of the public to an appreciation of, and acquaintance with, the work of these designers *as individuals*. Imitations there will of course be, but what of it? They will sell as such, and that is all that can be expected or that is necessary to place the business on a sound footing. Real art has nothing to fear from the imitator but deception. So long as his work can be clearly and invariably distinguished from the copy he can rest perfectly easy as to the measure of his own reward.

FIG. I.

A New Material for Light-Diffusing Globes

Without any exceptions worth mentioning, lighting fixtures have heretofore been constructed with the supporting parts as the dominant motive in the design. The light-sources and their accessories have been adapted to the fixtures at the best, and at the worst have been merely excrescences added in a purely adventitious manner. The first necessity of a fixture is, of course, to support the light-source; but in these days of high candle-power and high brilliancy units the diffusion and direction of the rays becomes a matter of scarcely secondary importance. The means used to accomplish this purpose must, therefore, occupy a correspondingly important element in fixture design.

To build a fixture around a globe may sound at first like building a house around the furniture, but even the latter is by no means so absurd as it sounds. Many a house could be vastly improved, both artistically and in usefulness, if the furniture had been taken into greater account by the architect. If the globe or reflector used can be so treated as to sustain the dignity of becoming the central motive of the design, then there is no reason why the metal or supporting parts should not be subsidiary, both in fact and in appearance.

The few exceptions that may be noted to the general rule of construction are those in which globes or bowls of sculptured alabaster have been used as diffusing mediums. In these cases the beauty of the material, the expense in fashioning it to its purpose, and the exquisite beauty of the finished article have been such as to render it distinctly the primary object of the fixture, the metal or supporting bars being quite as secondary as the base of a statue.

The art of glass making has made rapid strides within the past few years in this country, especially along the lines of manufacture known as pressing. Single pieces of a weight and size and beauty of finish are now produced, which would have been absolutely out of the question a few years ago. Within the past year a glass which has a remarkably close resemblance to alabaster has been produced on a commercial scale. When treated in similar manner, *i. e.,* fashioned into large globes or bowls with a sculptured design, this material, especially when in the usual position on a lighting fixture, cannot be distinguished from the natural alabaster. It is particularly effective for classical designs, as the illustrations will show.

Fig. 1 shows a chandelier in which a large central bowl of this material is supported by suitable bronze arms, and surrounded by pendant lamps, with small reflectors of the same material and character of design. The central bowl will give a semi-indirect illumination, as a considerable part of the incident light will be reflected to the ceiling, while the smaller pendant lamps will give direct light. The entire fixture should, therefore, be reasonably efficient, as well as highly artistic.

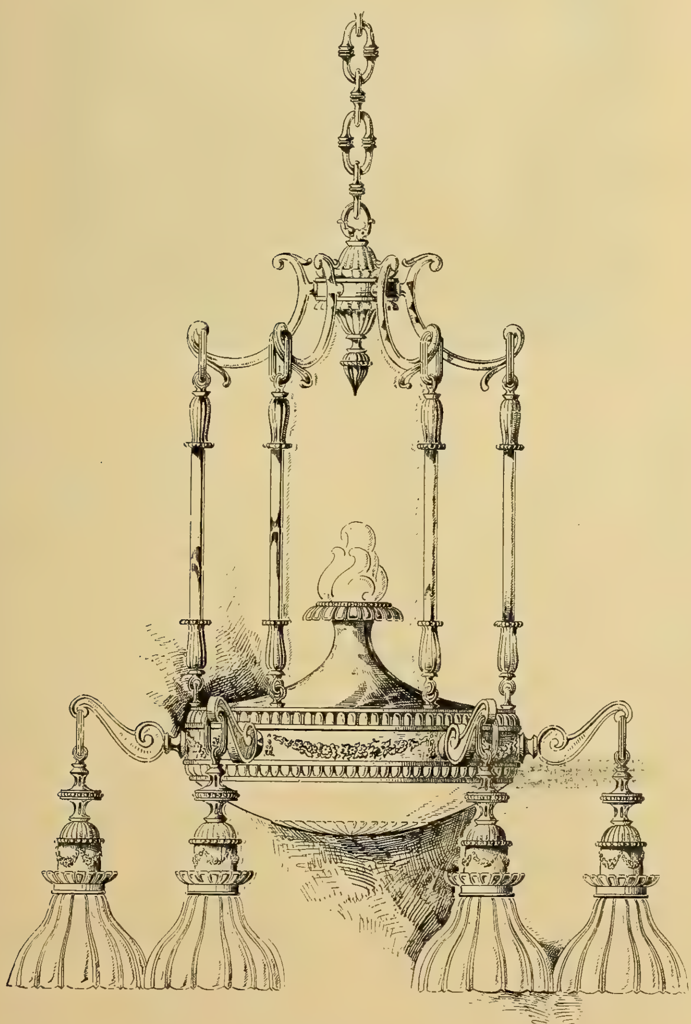


FIG. 2.

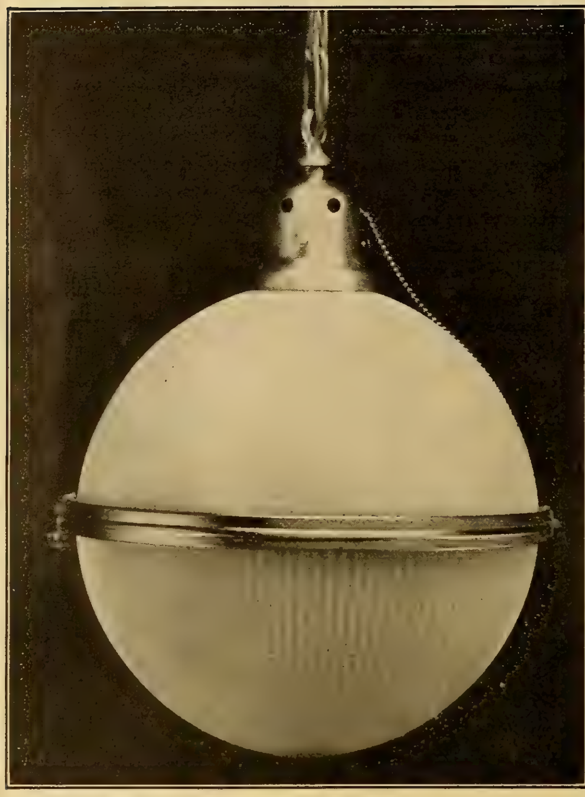


FIG. 3.

Fig. 2 shows another treatment of the material along classical lines. In both of these the supporting metal is frankly subsidiary to the glassware.

Fig. 3 shows a plain globe of the same material with a simple chain suspended. The illustration does not reproduce the peculiar alabaster quality of the glass.

The resemblance to alabaster is both apparent and real. Alabaster is a natural rock which is made up of intermingled transparent and white particles. This structure is reproduced artificially in this new glass. In the familiar opal glass the opaque particles which give it its white appearance are of microscopic size, so that it appears to be a homogeneous mass; in the new glass there is a matrix of transparent or crystal glass in which visibly large particles of opaque white material are suspended, thus reproducing the structure of the natural product.

A feature especially worthy of note in the fixtures illustrated is their absolute dependence upon a modern source of light. While those shown use the electric light it would not be impossible to adapt them to the newer forms of gas burners. In either case they are not imitations of candles or oil lamps.

This material offers large opportunities for a realization of the possibilities of modern light-sources in the design of lighting fixtures.

Theory and Technology

Flicker Photometry

By an English Correspondent.

The British Institution of Electrical Engineers has a most reprehensible practice of "lyin' low and sayin' nuffin'" in connection with the papers which are to be read at its meetings. Possibly due to a morbid distaste for publicity, or to a haunting dread of the trade journal, it will not permit the free circulation of the printed paper before it is read.

As a result of this the writer went to a meeting of the local section of the Institution, held at Newcastle-upon-Tyne, with a very faint idea of what was to be heard. The announcement was that a paper was to be read by H. Morris-Airey, M.Sc., F.R.A.S., on the use of the flicker photometer, and if the previous communication by Mr. Airey to the *Electrician* in August, 1909, had not been given a hint of what was to be expected, the fact that this paper was read so far from headquarters as Newcastle-upon-Tyne would have been sufficient to put one off the scent.

These notes do not profess to be a verbatim report of the lecture and discussion, but a resume cf the impressions given of the problems raised.

For many years Talbot's law, which can be understood better by a graphic diagram (Fig. 1) than by any windy definition, was held as gospel. This is, that if in a period of time A N impulses of light of magnitude A B be impressed intermittently on the retina of the eye, the vision will register a mean intensity A O over the period considered. In other words, if in time A N, rectangles A B C D, E F G H, K L M N, represent the quantities or bursts of light, while C D E F, G H K L represent (if one may so put it) the "breaks" in the light, then, if the speed of alternation from light to darkness is sufficiently high, the mean intensity of the light as registered by the eye will be O A, which is one side of a rectangle O A N D equal to the sum of the "bright" rectangles and on a time-base A N. A, as a matter of fact, for white light this gospel is about ninety-nine and a half per cent. true; that is to say, the ascertained error is about half a per cent., which would be good enough for us to settle the rival claims of gas and electric light by a flicker photometer if the two lights were exactly alike.

When, however, we consider lights of a different color to each other we get into trouble, because the human eye appears to be a desperately unscientific affair. To start with, the speed of the flicker head may spoil the test. We know that with intermissions of white light and total

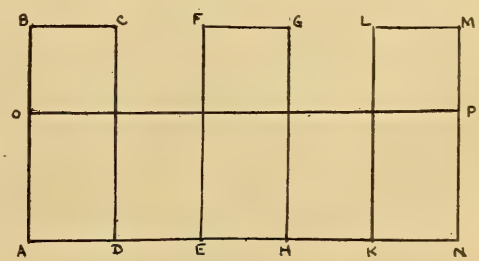


Fig. 1.

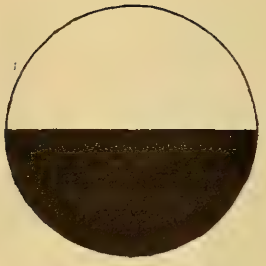


Fig 2.

Fig 3.

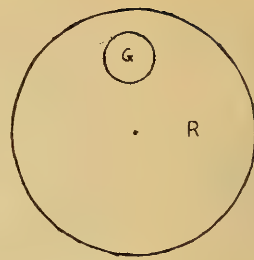


Fig 4.

darkness, fusion of the stimuli given to the retina, or the disappearance of the flicker, occurs at a frequency of about forty alternations per second for strong light and twenty-four per second for faint light; what frequency it takes place at when light is not contrasted against darkness, but one color of light against another, seems rather indeterminate. Any one who wishes to study this for himself can make a cardboard disk, as shown in Fig. 2, and make one half dark black and the other white. If he spins this from its center by means of an electric motor he can, by varying the speed of the motor, find out exactly the point when fusion takes place. He may vary this by taking colors in sections on the circle and finding out when flicker ceases.

If the experimenter wishes to still further demonstrate to himself that his eyes can be fooled, let him mark on the white half of his card three bold black arcs, as shown in Fig. 3. Let him be sure to have them as jet black as possible, so that there may be no mistake. If he then spins his card in the same way as before he will find that on rotation in one direction the outer circle which he will perceive will seem to be a dull reddish color, the middle circle will be a light stone color, while the inner circle will have a blue tinge. If he reverses the direction of rotation the tinges of the inner and outer circle will interchange, the middle one remaining stone color. He may substitute a red light for the ordinary light for observation, or may conduct the test by the aid of a Bunsen flame colored with rock salt—the yellowest flame known. His results will be the same. Yet the markings are indubitably black.

Another uncomfortable fact which has to be faced in trying to compare intensities of different colors is that the apparent ratios of light intensities from differently colored surfaces do not correspond with their real ratios. This can be shown by taking a screen, such as is shown in Fig. 4, consisting of a small disk, say of bright green, G, mounted on a large disk of dull red, R, and viewing it when illuminated by a beam of light, which can be varied in strength. As the light fades away it will be seen that the green patch stands out with apparent prominence long after the red disk has disappeared from notice. In other words, the apparent intensity of light on G is greater than on R, and yet, as both areas are illuminated by the same beam, their actual light intensities must be equal. If we pivot the disk R at its center and swing it round fairly slowly another eye deception will, if the eye has not previously been strained by a bright light, become apparent. A sort of yellowish mask will appear to be slipping off the lagging edge of the green disk into the red background—a " partial eclipse " effect which plays havoc with color vision.

The physiological theory as to what happens in the retina when it receives light which is most received in favor (in a more or less unreserved manner) by physicists is the Young-Helmholtz theory of three-color vision. It would appear that the construction of the retina adapted to secure vision contains two types of sensitive elements, the rods and cones. The former are found in large quantity in the outer area of vision, cones mingle with them in greater number as the small central region of clearest vision is approached, till at the center cones alone are present. Now the rods apparently receive stimulus from fainter lights than the cones, but

cannot differentiate between colors and are slower in stimulation than the cones. The cones, however, can keep active in light of such strength as would exhaust the rods. Moreover, they differentiate between colors. The theory now stated assumes that the cones are of three different sorts, sensitive to red, green and violet light, respectively, as shown in Fig. 5, the activity of the three kinds of cones varying from end to end of the spectrum, as shown by curves 1, 2 and 3. Any other color may be represented as combinations of the red, green and violet stimuli in suitable proportions, analogous to the beautiful effect of the stipples in a three-color print.

Now we can get a working explanation of the yellow mask in our previous experiment. It may be quite easily due to a lagging excitation of the rods due to a weak illumination beyond the ranges of the ordinary scale of the spectrum. As a matter of fact, if we look at a white beam through a spectroscope and shield the strong light, we may gradually become aware of a faint yellow glow beyond the limits of the ordinary spectrum that may be the stimulation of the retinal rods.

All this is, however, only theory, liable to be upset; as a matter of fact, the photographic plate is quite as capable of "seeing things" in the way of the striking phenomena of color vision as is the human eye, and it is somewhat difficult to attribute a system of rod-and-cone sensitive elements such as are ascribed to the retina. With every new physiological theory the physicist would have to start again to explain the flicker effect. Mr. Morris-Airey suggests that a good foundation for a physical (not a physiological) theory could be found in the experimental examination of the growth and decay of stimulus on the retina due to lights of different color. Any results so obtained could be kept carefully clear of physiological theory, which, as the most eminent

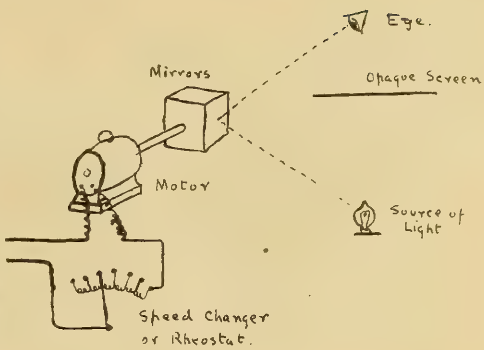


FIG. 6.

physiologists are hopelessly at variance, is perhaps wise. The material for such an examination is already to hand in the work of Mr. G. N. Stewart, which was reported so long ago as 1888 in the *Proceedings* of the Royal Society, Edinburgh.

Stewart, by means of observing the flashes of light reflected from a rotating mirror in a dark room discovered that apparently the color of the reflected light changed as the speed of rotation of the mirror was altered. This experiment can be repeated, as shown in Fig. 6, and it will be seen that these color changes take place below, or about the speed required for the flicker effect to disappear. This is attributable to the fact that the growth of the stimuli of the red, green and violet components of the beam does not take place uniformly, but that at one instant the red, at another the green and at another the violet stimulus upon the eye is predominant. This may be shown graphically by the curve, Fig. 7, reproduced from Mr. Morris-Airey's paper, time being shown horizontally, stimulus vertically. For a long duration of beam, such as overtime, O. A. (1-40 second for strong lights or 1-25 second for weak lights), the excitation of all three colors is equal and gives the sensation of white light. But where the stimulus only lasts for a shorter time, such as Oa_1, Oa_2, Oa_3, then, whichever stimulus is most prominent at the instant of cutting off the beam, the sensation due to that stimulus will be predominant. Hence when the light stimulus consists of a series of short illuminations there will be, according to the length of the stimulus and its frequency, different

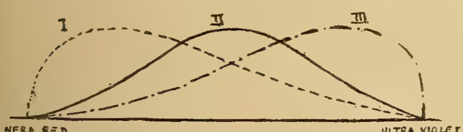


Fig 5

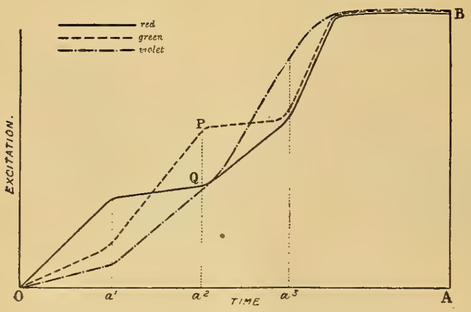


FIG. 7.

predominant tints. This does not particularly matter in a flicker photometer where two lights of precisely the same character were being compared, as, whatever the duration of flash, Oa_2, compared with fusion O A, the ratio of ordinates A B and a_2 P would be the same for each light, and a balance could be obtained. But suppose that we tried to compare, say, a red and a green light at a duration of flash Oa_2 Although the appearance seen by the eye might be a steady illumination of a color produced by mixing red and green light together, it would not necessarily follow that the actual brightness of illuminations at the flicker head had been adjusted to be the same. The effects really being compared would be that of a red light of intensity $\frac{Oa_2}{AB}$ times the real intensity, and a green light of intensity $\frac{Pa_2}{AB}$ times the real intensity. Moreover, if the speed of the flicker head is altered, the position of the ordinate considered will be moved to a point such as a_3, and the positions of the light sources will have to be moved in order to regain a balance.

The same arguments apply to the conditions of apparent balance of light from differently tinted lights, such as a carbon filament lamp and a metal filament lamp, and a very striking way of seeing the practical working effects is to treat a Simmance and Abady photometer, which has a reflector of the shape shown in Fig. 8, as viewed in various positions as a flicker photometer. If placed in such a position as B, it is possible to compare light intensities of lamps when the reflector is still. If the flicker effect is now used, however, it is extremely likely that the balance will be upset if the lamps are of unlike kinds. Where two sources of light, such as a metal filament and a carbon filament, are contrasted, there will probably be an error up to a maximum of 25 per cent. between the readings obtained by a fixed and a flicker photometer, and the matter was observed by Wild in the *Electrician* during the present year. The general effect of such flicker readings is, it is believed to be, against the metal lamp as contrasted with the carbon lamp.

The tremendous difficulty in practice of getting commercial photometric values for metal filament lamps was emphasized by Mr. Faraday Proctor, of Messrs. Edison Swan, Ltd., who was present and who has had exceptionally valuable experience in the manufacture of both carbon and metal filament lamps. He stated that it was difficult to get anything like consistency among test results on metal lamps when readings were checked by transposing operators. Girls who were able to test carbon lamps with the utmost accuracy could get no agreement when given metal lamps to test, and it takes a considerable amount of time and special education to get the testers to read accurately with these lamps.

The total result of Mr. Morris-Airey's paper and the interesting discussion which followed, appears to be that, useful as it would be to be able to evaluate the light obtained from such sources as enclosed arcs, flame arcs and gas lamps in terms of carbon filament lamps, it is doubtful whether, with different colors of light, it is even scientifically possible to talk of the comparison of intensities, much less to accomplish such a task.

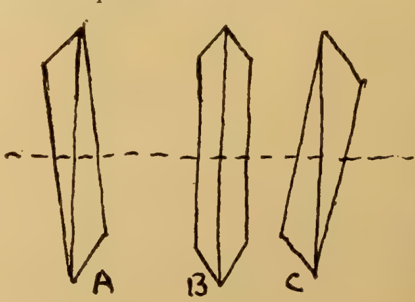


Fig 8.

The Gathering of the Clans

The tocsin has sounded; the word has gone forth, and all the tribes of the electrical domain are to meet again in annual conclave. This yearly gathering is assuredly a custom far more honored in the observance than in the breach. It is a power for good in many ways, and from every viewpoint. It has done a great work, but not so great as remains to be done.

The opinion of the onlooker, be it the result of some degree of circumspection and sympathetic interest, is not without value to those working within the lines. The private may on occasion give useful suggestions to the general, and the layman observe what has escaped the attention of the professional. It is from these considerations that we venture to speak familiarly of the work, past and to come, of the National Electric Light Association.

The association exists by virtue of the desire of the people for more and better light, and will subserve its purpose and fulfil its destiny to the extent to which it meets this demand. Contributory to this fundamental purpose there are a large number of subsidiary and more or less minor purposes. To the public it may appear that these purposes end in the single aim to acquire wealth at their cost; but this is quite as one-sided a view on the part of the public as it would be on the part of the electric lighting industry. As in all other human relations, the interests of the two are mutual. He who would have more or better light must share the profits of his own labor with those who work to give him these improvements.

After all considerations of finance and trade, of theory and practice, of policy and action, the whole subject reduces itself to the single question: How to induce the public to make more and better use of electric light. Light is good, and to persuade one to make more and better use of a good thing is assuredly a worthy labor.

Where Is More Light Needed?

A year ago we endeavored to point out the large and urgent need of the use of more light for street illumination. A realization of this need has unquestionably taken a large hold upon the public mind during the past year, but the work of supplying the need has only just begun. Municipal improvement of every kind is a live question in this country to-day, and among the reforms desirable, improvement in public lighting is one of the foremost. There is wide opportunity for successful effort in this direction at the very door of every central station in America.

Four years ago illuminating engineering was not even officially recognized by the association; to-day it has grown to such an extent that there is already a necessity for dividing its field. The science and art of public lighting offers a field of activity of ample scope to satisfy the ambitions of a first-class engineer. This department of lighting should receive the constant study and attention of every central station in general, and in the larger towns, of a special engineer in particular. This specialist should be more than a mere technical expert; he should

have a good knowledge of municipal economics, a genuine appreciation of his work, and the tact and personality necessary to interest the citizens in the cause of public lighting.

The value of the work that such a specialist could accomplish for a central station, to say nothing of the reputation which he would acquire for himself, is limited only by his own ability. A persistent campaign of publicity conducted along broad-gauge educational lines would probably bring a larger return in income and public good-will than any other single line of effort. It should be possible to double the use of electric current for public lighting in the majority of cases.

"The Great White Way."

A branch of lighting nearly allied to street illumination is that used for purely display purposes, such as signs, outlining, and spectacular effects. This is another field which may well accommodate a specialist. As sure as the boy delights in emulating the man, the smaller city or town seeks to emulate the metropolis. This laudable instinct finds its expression in reproducing on a small scale the best known features of the large city. How many "Broadways," think you, there are in this country? Until an equal number of towns have a "White Way" there is yet work to be done. The "White Way" of the metropolis is resplendent with electric signs and displays. Without this feature the chief element of attraction, so far as light is concerned, is wanting. Let every central station and citizen interested in glorifying his town take note of this fact.

The "Carnival of Light."

A number of the larger cities have found pleasure and profit in an annual electrical show held in some large auditorium. There is opportunity for attracting still greater attention by inaugurating the custom of an annual carnival of light, which could be a kind of electrical show held in the open. There are few of so crabbed a nature, or so hopelessly in the grip of dyspepsia as not to enjoy for a brief interval the absolute freedom from conventionality and the instinctive taste for frolic which constitute the carnival spirit. Prizes for the best lighted show windows, the most novel effects in electric signs, and the most gorgeous private illumination would bring about results that would astonish the populace. Let us by all means have the Carnival of Light.

Government Regulation of Illumination.

The time has arrived for legislative control, within just and reasonable limits, of the manner and methods of using artificial light for commercial illumination. The greatest of all the nation's resources is the health of its citizens. Every means of conserving these resources is therefore a proper subject for governmental consideration. The most elementary duty of a government is to protect the life of the individual from violence. If the infliction of sudden death by murder is a crime against humanity, the infliction of physical injury or disease is a crime of lesser degree only to the extent that its results are less disastrous.

It is now a recognized principle in civil government that conditions prejudicial to health may be forbidden or restricted by legal means to any extent that is practicable. The increasing use of artificial light brought about by the conditions of modern civilization, and the enormously augmented danger of modern light-sources when improperly used, puts the use of illumination unquestionably among those utilities which may properly receive supervision from the State.

The injurious effects of bad lighting in the public schools, in offices, factories, and work rooms are but little realized by the public at the present time. It is not always easy to trace disease or physical incapacity directly to its cause, but there can be no question as to the serious effect of eye-strain upon the nervous system and the general health. The quantity and quality of illumination furnished in the class of installations mentioned should have at least as careful supervision as ventilation and other sanitary utilities. The inspection of the lighting system should be included among the duties of the general factory inspector, and office buildings should be added to the list. Public schools and libraries should be examined

carefully as to their lighting equipment by a competent illuminating engineer working under the authority of those directing public education.

The Association should be foremost among organizations and individuals working for such legislation. Let us have a campaign inaugurated in every State for the purpose of securing the requisite legislation to insure the minimum of abuse of artificial light. The Association might well take up the matter in collaboration with the American Association for Labor Legislation, an organization whose energies are entirely devoted to securing the passage of laws that will protect the lives and health of all classes of laboring people. Such action on the part of the Association would be beneficial in every way. It would add greatly to public appreciation and confidence in those engaged in the lighting industry, and would attract such attention to the difference between good and bad lighting as would result in wide-spread and general improvement. The Association has continually widened and amplified the work within its own doors, *i. e.*, it has increased its efforts in behalf of its own prosperity. It may now well take up work less directly in the line of self promotion, but no less surely beneficial to the interest which it serves.

Public Education.

There is a vast amount of public ignorance on the subject of light. This will disappear in time in the natural course of evolution, but the disappearance could be materially hastened by well directed efforts toward public education. It is possible to reach public lighting and correct at least the worst abuses of legislative authority, but, at least in our government, such authority cannot reach the home. This can only be done by instructing the people directly on the subject. Courses of lectures on the subject, given either directly or in conjunction with some public institution, would be a most valuable means of securing a better practice in lighting. While the Association is subdividing itself so as to reach every individual in every town who is directly connected with the electric lighting industry, let it not forget the users of electric light, and expend some of their energies in instructing the public in the proper use of this commodity. The Association is financially and otherwise able to secure the best of talent for such public lectures, and the benefits that would ultimately accrue to the lighting industry would amply repay for all such expenditures.

Illuminating Engineering from the Workman's Point of View

Commercially speaking, industrial illumination, especially if it be made to include office lighting, comprehends a large part of the value of illuminating engineering. The fact that the labor item constitutes such a large part of the cost of any manufactured article, and that the value of labor, especially in this country, is so enormously in excess of the cost of artificial light by which the labor is performed, gives to this class of illumination an economic importance far in excess of any other lighting problem.

The value of the work of the illuminating engineer in industrial lighting is based upon a single consideration, viz., the efficiency of the laborer for whom it is provided.

The question of first cost of installation, and the maintenance and running charges, are insignificant compared with the effect of the illumination upon the output of the manufactured product. Of course, the engineer is bound to secure results by the most economical method possible, but as before stated, the cost of light is a mere trifle in comparison with the cost of labor, and is therefore of a secondary consideration.

Industrial lighting is a field in which the illuminating engineer should be particularly cautious about a too strict adherence to theories. "There are tricks in al. trades" says the proverb, and there are numerous little peculiarities and conditions in any particular line of industry with which only those are familiar who have learned them in the course of duty. The illuminating engineer who lays out a lighting installation on generalities and "fundamental principles" alone is more than apt to find that he has transgressed a number of special conditions which in the aggregate may wholly offset the ad-

vantages which he has secured in a general way.

While there is a considerable amount of prejudice on the part of workers, and ideas having no sounder basis than mere notion, it is nevertheless true that the really intelligent and skillful operative is entitled to a large measure of credence in his ideas of the particular kind of illumination which he should have. Thoroughly successful results in industrial lighting can only be expected from engineers who have the time, inclination, and ability to study the minutia of the subject on the ground. Tactful conversation and questioning of employees will bring to light suggestions and information which may be of more actual value than all the mathematical calculations put together. The whole subject reduces itself to the single question: Can the operative see to do the particular work in hand, under the particular conditions existing, with the greatest possible efficiency? The only place to learn the answer to this question is in the factory.

Free Advertising

The question of discriminating against the mention of goods or devices by their trade names, or in connection with their manufacturers, is one which is often difficult to decide in cases of papers presented before technical societies and articles contributed to the technical press. The American manufacturer and inventor is particularly keen to the high advertising value of such mention, and is not infrequently overzealous in his efforts to obtain it.

On the other hand, the officials of the technical societies and editors of technical journals occasionally stand so erect in maintaining the dignity of their positions as to lean backward. To omit the trade or manufacturers' name of an article, and yet describe it in unmistakable terms, is simply subterfuge, and entirely fails of accomplishing any useful purpose. The safest policy is to be absolutely frank and open in the treatment of the question. Ninety-nine per cent. at least of the inventions and discoveries which have made modern civilization what it is, originated in the expectation of commercial gain as the incentive. If only those devices or articles were described which have no commercial standing or value, technical societies and publications would be of no more value than a publication devoted to setting forth common dreams.

The question is rather distinctly divided into two different phases: First, the announcement of new discoveries and inventions; and second, the description of experiments or researches in which various kinds of apparatus and material are used. The inventor or discoverer of a new device or principle is clearly limited to a statement of his observations and the facts which they establish, which may be set forth with such use of logical argument as may be necessary. The moment unsupported claims, especially those which directly, or by inference, are intended to show the superiority of the device in question over others of its class, creep in free advertising begins.

A thing must have a name before it can become a topic of discussion, or even be described, and it is therefore quite proper that such a name, even though it be intended as a strictly trade designation, and even be protected by trade-mark registry, be used in the class of literature of which we are speaking. If an article becomes generally known by such a trade name, so that it can only thus be unmistakably designated, there is no sufficient reason for "beating around the bush" when referring to the article in scientific literature. The purpose of announcing or describing a new discovery or apparatus is to enable the public to avail themselves of whatever advantages it may possess, and it is of no use unless they know where and how to get it.

The question as to how far a writer may go in mentioning articles by their trade names in technical literature is one which is more often met with. If the article in question is descriptive of experimental or research work, then the writer should be as accurate as possible in the description of every article, material or piece of apparatus that is used. The purpose of such reports is not only to give the results obtained by the particular experimenter, but to enable others to either judge of the reliability of the results reported or to repeat the experiments in order to check up the results for themselves.

In every case it is essential that there be no doubt as to the exact method of procedure followed. It is better to err on the side of too minute detail than on the side of omission. If the maker's name is necessary in order to distinguish a particular kind of photometer, or electrical instrument, or other device, then the maker's name must appear in order to remove doubt. While such mention possesses certain advertising value, it is a legitimate and justifiable tribute to the manufacturer.

All of this is on the assumption that the article in question is a bona-fide report of experimental work.

It is quite possible to use certain apparatus or material as a ground work upon which to build an ostensible scientific description, and it is this sort of free advertising that the publisher and technical society has to guard against. Intent plays a large part in ethics, and it is quite impossible to lay down any hard and fast rule which can be followed to the exclusion of considerations of motive. However, it does not take an undue amount of experience and acumen to distinguish between the genuine and the spurious effort to impart original knowledge, and every effort should be made to foster the dissemination of the results of original work without being prejudiced by the occasional efforts made to secure free advertising.

The Perfection of the Tungsten Lamp

The announcement that the metal tungsten has been successfully drawn into wire of the requisite fineness for lamp filaments, and that the process is practicable on a commercial scale, undoubtedly marks the last step in the improvement of the metal filament lamp, so far as its construction and service is concerned. The efficiency of the tungsten lamp depends very largely upon its single quality of resistance to fusion. There is doubtless some advantage in the way of selective radiation, but this alone would not constitute an improvement of note.

Apparently also the limit of efficiency of light production from an incandescent solid has also now been reached. Whether the metal filament lamp is destined to possess the field for a quarter of a century or more, as did the carbon filament, remains to be seen. However this may be, its successor is pretty sure to be a vapor lamp of some description. By far the highest efficiency to-day in the production of light electrically is from incandescent vapors, as utilized in the mercury arc, whether produced in a glass or quartz tube and the flaming arc, including those using carbide and metallic oxide electrodes.

While the principle of luminescence, as exhibited occasionally in nature, displays enormously higher efficiency than incandescent vapor, the likelihood of it being turned to practical use is not especially encouraging at the present time.

Beside the single advantage of efficiency, incandescent vapor has the desirable quality of lower intrinsic brilliancy, so that we may safely say that the limit of glare has also been reached. Future developments in light-sources are practically sure to work toward lower intrinsic brilliancies and larger luminous areas.

The field is still an exceedingly inviting one for the scientific explorer. The commercial value of light reaches such an enormous sum that any improvement in its production offers an enticing prize commercially, while its universal use affords equal opportunity for fame and glory. We are only in the beginning of the improvements in the production of light.

Lighting Glassware

The importance which glassware, in the shape of globes, shades and reflectors, possesses in illumination has received greatly increased attention during the past year. This stimulation of interest may be traced to several causes. Doubtless the foremost among these is the remarkable development and use of prismatic glass. Before the commercial advent of the prism globe and reflector the making of illuminating glassware was simply a matter of common commercial glass making. The single purpose of the manufacturer was to get a "pattern" that would sell. It was on precisely the same plane as the making of tableware or bar goods; in fact, with a few exceptions they were all made in the same factory and often shipped out in the same package. Whiskey glasses, common tumblers, berry bowls and shades have many a time been traveling com-

panions in the same barrel. A continuous and aggressive campaign of education conducted by the prism glass manufacturers succeeded eventually in establishing the fact in the lighting industries that the glassware is an important adjunct to any light-source or lighting device, and must be respected accordingly.

Another important factor in the development of lighting accessories has been the establishment of illuminating engineering. Practical illuminating engineering had its beginning in the recognition of the necessity of modifying the rays from the new modern high-power light-sources. The old method of laying out lighting installations was to figure the cubic feet of space and provide a 16-c.p. lamp for so many cubic feet. No account was taken of the effect upon the lamp of the shade or reflector used. The lamp might be used bare, or with an opal or other diffusing globe which would absorb three-fourths of its light; or, again, it might be used with a form of globe that would give the larger portion of the light in the upper hemisphere, or with a reflector which would confine the rays to a comparatively small area beneath the lamp.

The first essential of engineering is economy, and the first problem of the illuminating engineer was therefore to study the means of utilizing the rays emitted by a given light-source so as to produce the maximum amount of available illumination. In this study the first thing encountered was this question of glassware. Not only were the exceedingly wasteful effects of most of the globes or shades in common use unearthed, but having discovered their defects the question of designing more efficient accessories arose.

So far as practical use is concerned, the consideration of the design of lighting glassware as a scientific problem is scarcely more than ten years old. The great amount of attention given to the subject to-day, both by manufacturer and consumer, shows a wonderful degree of progress within this decade. Within the past year the relation of illuminating engineering to the decorative side of lighting has been more largely dwelt upon than at any previous time, and along with this recognition of the *art* of illumination has come an awakening on the part of manufacturers of lighting appliances, including both fixtures and accessories, to the importance which they bear to illuminating engineering practice.

The manufacturing of lighting glassware is no longer looked upon as a mere matter of blowing or pressing glass. There has been a remarkable degree of effort given to the production of accessories which shall combine to the highest possible extent both decorative effect and efficiency of results. A great number of antiquated and trite designs have been relegated to the scrap heap, and in their place have come both new forms and new materials. The past year in fact has witnessed a genuine renaissance in the art of lighting glassware. Now that the importance of the subject has been generally recognized and work begun in earnest, we may expect to see still greater improvements in the coming year.

While the improvements thus far made are commendable, there is still plenty of room for progress. It is to be hoped that those who have already undertaken the good work will continue, and that still more talent will find in this field a sufficient attraction to induce them to take up the work. The public are always ready and willing to pay a reasonable price for originality and improvement in any line, and those who succeed in producing really new effects in lighting glassware, which embody either higher expressions of art or conduce to a more economical use of light, may be sure of reaping a fair reward.

The Convention Daily

A change in the method of handling this feature of the convention is to be made at the St. Louis meeting. The representative technical journals in the field of electric lighting have accepted the invitation of the association to join in editing and publishing the daily.

This is a particularly happy solution of the problem. It gives official recognition of the work which the technical press is doing to promote the interests of the association and brings to the publication the experience of a trained corps of editors and writers.

Notes and Comments

"CARNIVAL OF LIGHT" BETTER THAN "OLD HOME WEEK."

PHILADELPHIA SUBURB TO CELEBRATE COMPLETION OF ITS NEW LIGHTING SYSTEM IN THE FALL.

The setting aside of a week for reunion festivities for the purpose of keeping alive the memories of, and interest in the " home town " has become quite general throughout the Eastern States. It is a wise and commendable custom. As light is the very emblem and essence of hospitality and good cheer, it is befitting that on these occasions special attention be given to decorative and spectacular illumination. The suburb of Frankford, Philadelphia, is so enthusiastic over its new lighting system that it proposes to substitute appropriate services on its installation in place of its regular " Old Home Week ":

There will be no celebration in Frankford this fall such as the successful Home Week Carnival of last fall, but in its place there will be services marking the completion of the new lighting system which is to be installed in Frankford during the summer. This decision is the result of a conference of a committee of the Frankford Board of Trade with the Home Week Committee, which has been retained as a permanent body to conduct such affairs.—*Philadelphia Record.*

WHAT DO YOU KNOW ABOUT THIS?

LIGHTING RAILWAY CARS WITH TUNGSTEN LAMPS IS A HOT FILAMENT PROPOSITION.

There is no single lighting problem in which efficiency is of so great importance as in railway coaches, since in no other case is the generation of current so expensive. The fragility of the tungsten filament has been a bar to its use in this class of lighting heretofore. The method of overcoming this by keeping the filament hot while the lamps are extinguished seems simple enough in theory; what it will prove in practice is soon to be tried out by the Pennsylvania Railroad Co.:

A new system in the lighting of the steel passenger coaches of the Pennsylvania lines is being installed in the Altoona shops. Fifty cars are being fitted with what is known as the hot filament system. These cars, when completed, will be lighted with tungsten lamps, which will replace the old Gem lamps. An electric current will pass through the filament in the lights continuously, 60 volts while lighted and 4 volts while unlighted, the latter being sufficient to keep the filaments from breaking. Gas lighting was installed by the Pennsylvania Railroad fifty years ago.—*Westchester News.*

DECORATIVE STREET LIGHTING MAKING HEADWAY IN THE EAST.

WORCESTER, MASS., AGITATING THE MATTER OF BETTER PUBLIC LIGHTING.

We have frequently remarked upon the greater enterprise shown in Western cities in the matter of the new public lighting. While the East is unquestionably more conservative, it is not by any means opposed to improvements that have demonstrated their value, and better public lighting is certainly to be included in this class. It is easy to believe anything in regard to the growth of a Western city, but it is not generally known that some of the Eastern cities, without making the slightest noise about it, are showing a greater development than many of the loudly boomed Western towns. Worcester, Mass., is an example. It should lose no time in getting in line with the best modern practices of public lighting:

There will be a meeting to-night of the special committee on electric lighting of the Worcester Merchants' Association in the directors' room of the Commonwealth Club to consider matters pertaining to the better illuminating of Main and Front streets. Several plans have been under consideration by the committee, but the most feasible one seems to be that of suspending arches across the street at certain intervals in such a manenr as to prove artistic as well as practical. —*Worcester Gazette.*

IS THE ARC LAMP LOSING GROUND AS A STREET ILLUMINANT?

THE TUNGSTEN LAMP REPLACING THE ARC IN MANY CASES.

The tungsten lamp is making good headway in correcting the worst abuses of electric street lighting. Where it is manifestly impossible from the financial standpoint to attempt street illumination —*i. e.,* to give such an intensity over the entire street as will make it fairly visible— the electric arc is entirely out of its sphere, and its frequent use in such instances has constituted one of the most flagrant violations of illuminating engineering princi-

ples. Happily, this condition is rapidly passing away. The two instances related below are examples:

FREMONT, NEB.—Lamp-posts carrying a group of electric bulbs may replace arc lights in Fremont, if a scheme inaugurated by former Mayor Wolz is carried out. Mr. Wolz is making a canvass of the city, and so far has succeeded in getting some 20 business men to put in the lamps. The business men are to furnish the lamps under the scheme, with the understanding that the city will make no charge for the electricity.—*Lincoln Journal.*

SCRANTON, PA.—If the intention of Director of Public Works C. V. Terwilliger is carried out a number of electric arc lights in different sections of the city will be replaced by incandescent lights within the next few weeks. An inspection tour by the director reveals that arc lights are shedding their effulgence in courts, alleys and out of the way places, as well as in the middle of blocks, where there is another light at each end.

The director plans to remove the arcs from these locations and install the incandescent, which will answer the same purposes. The arcs cost the city $50 a year and the incandescents can be had for $15.—*Scranton Times.*

THE LONGEST "WHITE WAY" IN THE WORLD

THE DISTINCTION OF ITS POSSESSION BELONGS TO MINNEAPOLIS.

Minneapolis was among the first of the important cities to install a thoroughly good modern decorative street lighting system. That it has proved in every way a valuable investment is evidenced by the fact that it has been continually increased, and with the erection of the ornamental standards now under contract it will have one of the finest systems in the world:

The Council Gas Committee yesterday awarded to the Flour City Ornamental Iron Works the contract for furnishing and installing 20 ornamental street lights on the steel arch bridge and approach to East Channel. When these lights are put in Minneapolis will have the longest continuous stretch of this character of lights in the world, running from Nicollet avenue and Tenth street to Central avenue and Seventh street on the East Side. The contract price for the bridge lights is $163 each.

During the meeting the subject of the taking over by the city of the maintenance of all the lights which have been, or are to be installed, came up. The city is now paying for 88 of them and there are 380 in all. The others are paid for by the abutting property owners.

The city took over the 88 after they had been put in and maintained a year by the Publicity Club in co-operation with the property owners. Alderman DeLaittre said yesterday that the city may have difficulty in securing sufficient money to keep up all the lights and he wanted that understood by the promoters.

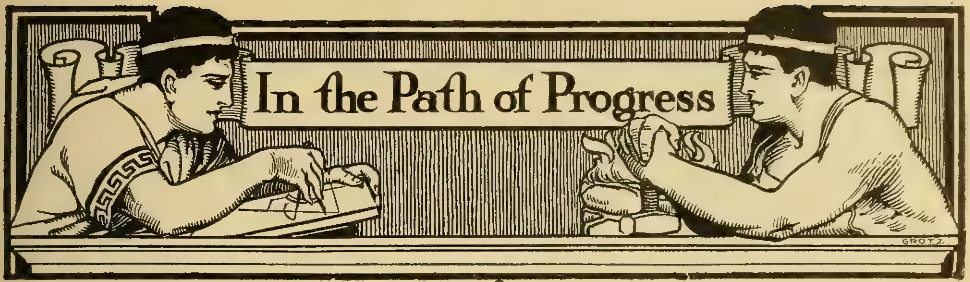
The Publicity Club expects when it finishes its campaign for better lighted streets in the business district to have 500 of these ornamental lights installed. This involves a maintenance expense of $78 a year for each light, or $39,000.—*Minneapolis Tribune.*

LINCOLN, NEBRASKA, BELIEVES IN DOING THINGS WELL

ITS NEW STREET LIGHTING SYSTEM WILL BE FIRST CLASS IN EVERY PARTICULAR.

"What is worth doing at all is worth doing well" is a truism which particularly applies to the new street lighting. Wood, or even cheap iron lamp-posts, set upon an insecure foundation are certainly a poor investment at any price. The public does not like to be called upon to replace or repair work that is naturally of a permanent character:

When the order for combination trolley and lighting poles in the business district of Lincoln was placed with a New York company several days ago, in accordance with financial pledges from property owners on 21 blocks, it was on the promise of delivery within 60 days. Whether or not this promise will be fulfilled remains to be seen. The Commercial Club hopes to have the poles up before State fair time, and if they are delivered by the middle of July they can probably be installed so as to furnish illumination during fair week. It will be no light job to put them up, as each weighs 1600 lbs., and is to have a 6-ft. concrete base. The cost laid down in Lincoln is $68 per pole and the expense of installing them is estimated at $12 each. This includes the concrete setting, labor, wiring, four tungsten lamps of 80 candle power and a shock arrester for each light.—*Lincoln News.*



Public Education as a Method of Advertising

The history of the successful invention, when fully written, is found to be largely a record of dogged persistence, a strenuous fight with ignorance, prejudice, and commercial opposition, and a large expenditure of money. It is true that the article of merit will win of its own accord in time; but this process of natural growth is so slow that not much can be expected from it in the first generation, and most of us want to see our purposes accomplished during our own lifetime. The only sure method of reaching this is by a well directed campaign of public education. This is, of course, expensive, but it is always a good investment. A comprehensive campaign of this kind always carries with it a very considerable amount of general benefit to the public, and no small amount of benefit to the competitors of those who are bearing the burden of the propaganda. Such methods are therefore never undertaken by the near-sighted and the avaricious, but only by those whose breadth of view, patience, and bank account are sufficient to enable them to wait for the larger result of tomorrow instead of taking the smaller profit of to-day.

It is a pleasure to note that of this class of commercial wisdom and far-sightedness the lighting industries are among the foremost, if in fact they do not actually stand at the head. Public education in the use of light is systematically followed by a large number of central stations and gas companies, and is accomplishing results that are satisfactory alike to the companies and to the people.

This method of advertising,—for advertising it is when reduced to its ultimate purpose,—has perhaps been carried out to a more elaborate extent by the Holophane Co. than by any other single concern in the country. From the very beginning of the exploitation of the glassware manufactured under this name, public education, in the way of papers and lectures before scientific societies, and contributions to the technical press, formed the basis of the campaign.

The idea of combining public instruction in matters of lighting with theatrical entertainment is certainly an innovation in advertising methods which is as remarkable for its boldness as for its originality. The mere statement of this combination gives an unpleasant suggestion of the third-rate vaudeville that has sometimes been given as a medium for advertising "fake" articles, but the facts in this case thoroughly dispel any such ideas. The experimental demonstration of a scientific fact, or law, made before the eyes of an audience has a fascination and interest which cannot be excelled by any form of pure amusement; as the public lectures of the late Professor Tyndall bear evidence.

The successful accomplishing of this difficult task on the part of the Holophane Company is due to Mr. F. L. Godinez, who has, in addition to thorough engineering training, the rare faculty of making scientific experiments striking. The lectures which he has given in several of the large cities under the auspices of the local lighting companies have attracted large audiences, and exceedingly complimentary press notices.

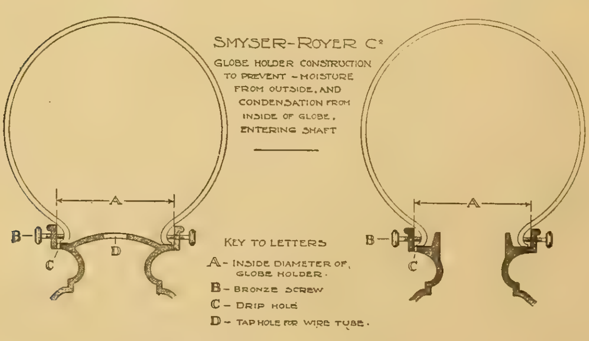
There is probably no people on the face of the earth who are so fond of amusement as the Americans, and so long as some useful purpose is combined with amusement no one has a right to object.

To stimulate an interest in illumination, and to impress its importance on the mind by examples, even though they be spectacular, is a worthy object. The Holophane Company is deserving of all praise for the extensive campaign of public education which it is pursuing.

An Improved Globe Holder for Street Lamps

The success or failure of large enterprises is often seriously interfered with, if not actually prevented, by apparently trifling annoyances. Many a promising scheme has had to be abandoned after the expenditure of much energy and money because of some little " kink " of which no notice was taken. The method of holding a globe for a street lamp would seem at first sight to require no more ingenuity than the pasting of a sign on a billboard. The weather, however, has to be reckoned with; and rain, snow, and ice, can prove exceedingly troublesome events in the life of a street lamp and globe. To find that the screws which hold the globe cannot be turned because they are rusted fast is an incident which may not only prove exasperating, but may cause a serious loss of time on the part of the trimmer.

The difficulties of the problem have apparently been solved in a very satisfactory manner by the Smyser-Royer Co. of Philadelphia. The construction and advantages of their globe holder are made sufficiently clear in the accompanying illustration. The screws holding the globe are made of bronze, which forestalls any liability to becoming rusted fast.



THE SMYSER-ROYER COMPANY'S NEW GLOBE HOLDER FOR STREET LAMPS.

It is safe to assume that such careful attention to details as is here exhibited is characteristic of the goods put out by these manufacturers.

" Central Station Stimulation "

" Central Station Stimulation " is a handbook of 240 pages, size 6 x 9 in., price $1, issued by the Central Station Development Company of Cleveland, Ohio.

" New Business—How to Find It—Get It and Keep It." Giving a complete working system with contracts, card index, form letters, files, folders, etc., of tried out and proven sales methods for fixtures and current consuming devices throughout the broad field from city lighting to vacuum cleaning campaigns.

The co-operative development of commercial houses and residences to the distinct advantage of the central station, the dealer, the contractor and the community to be served. " A plan to weld together and strengthen a general policy of co-operation which will serve all with equal fairness . . . that the greatest good may be secured for the greatest number."

This handbook could well be called the " Book of Know How " for those interested in this important department of public utilities in which experience is most valuable and mistakes most costly.

Public service companies are placed on a footing similar to that of any good mercantile establishment in the preparation, follow up and conclusion of sales campaigns.

Scientific lighting and illuminating engineering have very properly been given considerable attention in covering interior and exterior lighting, both for business sections and the important but much neglected residence districts.

The book is filled with good, clean, hard practicabilities boiled down from the experiences of tried, successful new business methods of the kind which can be used by central station managements

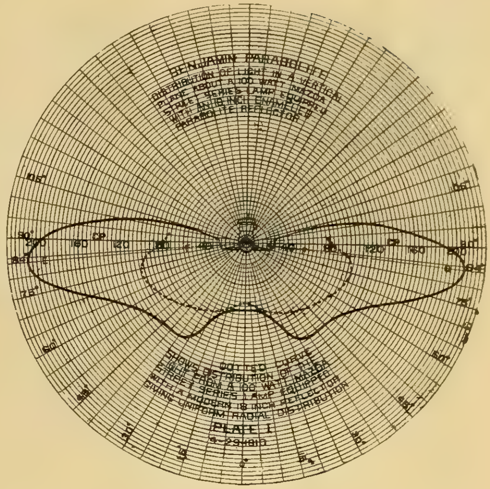
everywhere " in the invasion of a field, enormous, almost beyond all conception."

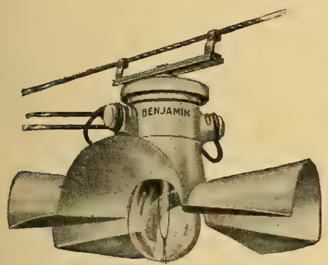
A New Street Lighting Reflector

At last something entirely new, or, at least, entirely different from the various types of reflectors that have thus far been in common use has made its appearance on the commercial horizon. It is put forth under the trade name of " Parabolite," and is manufactured by the Benjamin Electric Mfg. Company, Chicago.

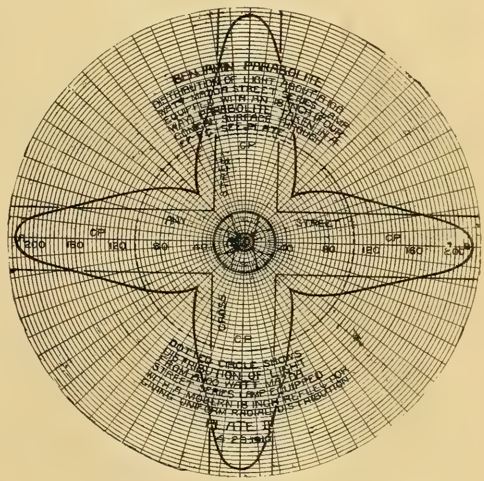
The device consists of parabolic reflectors cut in halves, these halves being attached to a central support. The purpose of the reflector is to direct the light of the lamp up and down the street, or along two intersecting streets. The construction and general appearance of the device is clearly shown in the illustrations. The photometric curves give the results, both in the horizontal and vertical planes.

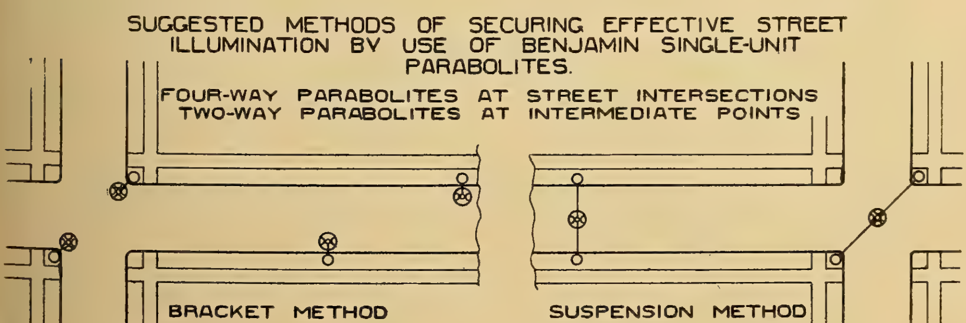
This new device seems to be a decided step forward in the problem of the economical use of the light of an incandescent lamp for street illumination.





THE NEW BENJAMIN PARABOLITE.





Proceedings of Technical Societies

The Program of the National Electric Light Association Convention, St. Louis, May 23-27, 1910

The remarkable growth of this association is shown in many ways, among the most conspicuous of which is the increasing length of time devoted to the presentation and discussion of papers and committee reports at its annual convention. This year four whole days are required, with double sessions running. The number of papers of direct interest to illuminating engineers is especially noteworthy in the coming convention. The entire general session of Tuesday afternoon is given up to such papers, in addition to which there are two other papers on lighting subjects. The complete program is as follows:

TUESDAY, 10 A. M.

First General Session.

Welcome to St. Louis.

1. President's address.
2. Announcements.
3. Report of Editor of Question Box—John C. Parker, Rochester, Rochester Railway and Light Company.
4. Report of Editors on Question Box Revision—Paul Lüpke, Trenton; Alex. J. Campbell, New London, New London Gas and Electric Company.
5. Report of Committee on Progress—T. C. Martin, New York.
6. Paper—Super-Specialization—P a u l Lüpke, Trenton, Public Service Corporation.
7. Report of Committee on Membership—H. H. Scott, New York, Doherty Operating Company.
8. Report of Official Representative on National Conservation Commission—Dudley Farrand, Newark, Public Service Corporation.

TUESDAY, 2.30 P. M.

Second General Session.

1. Report of Lamp Committee—W. F. Wells, Brooklyn, Edison Electric Illuminating Company.
2. Paper—Periodic Lamp Renewals—A. G. Strickrott, Schenectady, Schenectady Illuminating Company.
3. Magnetic and Flaming Arc vs. Open and Inclosed Carbon Arcs for Street Illumination—W. D'A. Ryan, Schenectady, General Electric Company.
4. Paper—New Form of Tungsten Lamp—C. F. Scott, Pittsburgh, Westinghouse Electric and Mfg. Company.
5. Paper—High Efficiency Lamps—S. E. Doane, Cleveland, National Electric Lamp Association.

WEDNESDAY, 10 A. M.

First Technical Session.

W. W. Freeman, Chairman.

T. C. Martin, Vice-Chairman.

1. Report—Overhead Line Construction Committee—Farley Osgood, Newark, Public Service Corporation.
2. Paper—Location of Faults in Underground Cables—W. A. Durgin, Chicago, Commonwealth Edison Company.
3. Paper—A New Departure in Distribution Construction Methods—S. B. Way, St. Louis, Union Electric Light and Power Company.
4. Report—Grounding Secondaries—W. H. Blood, Jr., Boston, Stone & Webster Corporation.
5. Paper—Use of the Oscillograph in Fuse Testing—Alex. Maxwell, New York, New York Edison Company.

WEDNESDAY, 10 A. M.

First Commercial Session.

Frank W. Frueauff, Chairman.

George Williams, Vice-Chairman.

1. Paper—Latitude of Commercialism—Arthur S. Huey, Chicago, H. M. Byllesby & Co.
2. Paper—Residence Lighting—H. J. Gille, Minneapolis, Minneapolis General Electric Company.

WEDNESDAY, 10 A. M.

First Accounting Session.

John F. Gilchrist, Chairman.

John L. Bailey, Vice-Chairman.

1. Report—Committee on Uniform Accounting—John L. Bailey, Baltimore, Consolidated Gas, Electric Light and Power Company.
2. Paper—Accounting Methods as Applied to Detroit Properties—E. J. Bowers, Detroit, Edison Elec. Illum. Company.
3. Paper—Care and Handling of Cus-

tomers' Accounts—J. M. Mulvihill, Denver, Denver Gas and Electric Company.

4. Paper—Storeroom Accounting—R. F. Pack, Toronto, Toronto Electric Light Company.

WEDNESDAY, 2.30 P. M.

Second Technical Session.

1. Report—Meters Committee—G. A. Sawin, Newark, Public Service Corporation.

2. Paper—Space Economy of Turbo Generators—Paul M. Lincoln, Pittsburgh, Westinghouse Electric and Mfg. Company.

3. Paper—Direct Current Turbo Generators—W. L. Waters, Pittsburgh, Westinghouse Electric and Mfg. Company.

4. Report—Gas Engine Committee—I. E. Moultrop, Boston, Edison Electric Illuminating Company.

5. Paper—Gas Engine Plant for Central Stations—Nesbit Latta, Milwaukee, Allis-Chalmers Company.

6. Paper—Interesting Points About Modern Transformers—E. G. Reed, Pittsburgh, Westinghouse Electric and Mfg. Company.

WEDNESDAY, 2.30 P. M.

Second Commercial Session.

1. Paper—Advertising—H. K. Mohr, Philadelphia, Philadelphia Electric Company; C. W. Lee, New York, C. W. Lee Company.

2. Paper—Automobiles—Hayden Eames, South Bend, The Studebaker Company.

3. Paper—Ornamental Street Lighting—E. L. Elliott, New York, Illuminating Engineering Pub. Company. Illustrated with lantern slides.

WEDNESDAY, 2.30 P. M.

Second Accounting Session.

1. Paper—Significance of Statistics—George A. McKana, B. F. Maguire, Chicago, Commonwealth Edison Company.

2. Paper—Classification of Income and Sales—W. W. Daw, Boston, Stone & Webster Corporation.

3. Paper—Job or Work Order System—R. D. Rubright, Brooklyn, Edison Electric Illuminating Company.

WEDNESDAY, 8 P. M.

Anniversary Meeting.

1. Paper—Founding the Association—E. A. Sperry, New York.

2. Address—Twenty-five Years of Commercial Central Station Development—Samuel Insull, Chicago, Commonwealth Edison Company.

3. Report—Public Policy Committee—W. W. Freeman, Brooklyn, Edison Electric Illuminating Company.

4. Election of Nominating Committee.

5. Report of Secretary and Treasurer.

THURSDAY, 10 A. M.

Power Transmission Session.

D. B. Rushmore, Vice-Chairman.

1. Paper—Present Problems in Power Transmission—F. M. Buck, New York.

2. Address—The Public and the Water Powers—Henry L. Doherty, New York.

3. Paper—Phenomena of Power Transmission at Highest Voltages—Dr. Charles P. Steinmetz, Schenectady, General Electric Company.

4. Paper—Randall, Pittsburgh, Westinghouse Electric and Mfg. Company.

General discussion on Organization and Work.

THURSDAY, 10 A. M.

Third Commercial Session.

1. Paper—Sales Department Organization—T. I. Jones, Brooklyn, Edison Electric Illuminating Company.

2. Paper—A Plan to Interest National Advertisers in Electric Publicity—Frank B. Rae, Jr., New York, Selling Electricity.

3. Paper—Industrial Lighting with Incandescent Lamps—S. H. Hall, J. M. Hoit, Paul Bauder, Cleveland, National Electric Lamp Association.

4. Paper—Prompt Execution of Orders—C. N. Stannard, Denver, Denver Gas and Electric Company.

5. Paper—Electricity on the Farm—Herman Russell, Rochester, Rochester Railway and Light Company.

THURSDAY, 10 A. M.

Third Accounting Session.

Paper—The Workings of a Collection Bureau—John C. Van Duyne, New York Edison Company.

Paper—Meter Records—Douglass Burnett, Consolidated Gas, Electric Light and Power Company, Baltimore.

Paper—Accounting Symbols—Holme, New York Edison Company.

THURSDAY, 2.30 P. M.

Third Technical Session.

1. Report—Committee on Protection from Lighting and Other Static Disturbances—B. E. Morrow, Albany, Hudson River Electric Power Company.

2. Paper—Comparison of American and European Switchboard Practice—Stephen Q. Hayes, Pittsburgh, Westinghouse Electric and Mfg. Company.

3. Paper—Voltage Control of Generators and Feeder Systems—F. W. Shackelford, Schenectady, General Electric Company.

4. Paper—Feeder Regulators—E. E. Lehr, Pittsburgh, Westinghouse Electric and Mfg. Company.

5. Paper—Water Intake from the Mississippi River for Two Electric Generating Stations in St. Louis—John Hunter, St. Louis, Union Electric Light and Power Company.

6. Paper—Precautions When Using Instrument Transformers—L. T. Robinson, General Electric Company, Schenectady.

THURSDAY, 2.30 P. M.

Company Section Meeting.

W. C. L. Eglin, Chairman.

1. Paper—Educating the Central Station Employee—Prof. S. W. Ashe, New York.

2. Address—Henry L. Doherty, New York.

3. Discussion by Representatives of Company Sections on Best Methods of Co-operation and Development of the Usefulness of the Sections.

FRIDAY, 10 A. M.

Third General Session.

1. Report—Committee on Preservative Treatment of Poles and Cross Arms—W. K. Vanderpoel, Newark, Public Service Corporation.
2. Report—Committee on Terminology—W. H. Gardiner, Jr., New York.
3. Report—Insurance Expert—W. H. Blood, Jr., Boston.
4. Paper—Decentralized Steam Plants—R. D. DeWolf, Rochester, Rochester Railway & Light Company.
5. Paper—Methods of Deriving the Neutral for Direct Current Three-wire Systems—James R. Werth, Jr., General Electric Company.
6. Memorials—T. C. Martin, Executive Secretary.
7. Report—Nominating Committee.
8. Election of Officers.

The Illuminating Engineering Society

At the May meeting of the New York section two papers were presented. One on "A High Efficiency Reflector for Street Lighting," by Dr. C. H. Sharp, and the other on "Illumination Tests," by Dr. C. H. Sharp and Preston S. Millar.

The following introductory paragraph from Dr. Sharp's paper will express the subject of street lighting.

"The problem of the satisfactory illumination of public streets and highways is one which we shall always have with us. The extent of the streets requiring illumination is practically limitless and the demand for more light is unceasing. The brilliant blaze of Broadway which represents the maximum of street illumination to-day may be the standard of First avenue a few years hence. Residential streets are far better lighted to-day than they were in the days of the open gas flame, but the illumination is still insufficient. Country highways which a few years ago were in Stygian darkness are now outlined by street lights, but with the increasing density and speed of highway traffic, the need of a more effective highway illumination is becoming more and more imperative."

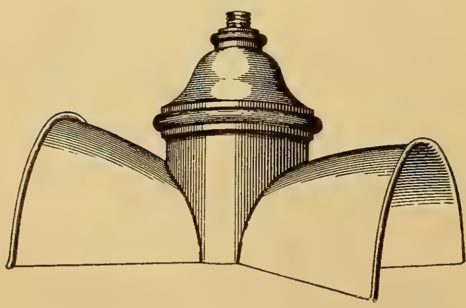


FIG. 1.—THE EQUILUX REFLECTOR.

The form of the reflector which he describes is shown in the illustration. A number of curves showing the percentage gained in illumination over the bare lamp are given. As this method of plotting is entirely new the curves are not as expressive as they would otherwise be. The reflector shown is precisely on the same plan as that recently put upon the market by a well-known manufacturer under a different trade name. This seems to be rather a remarkable case of inventive coincidence, which is by no means unknown in scientific discovery.

The illumination tests reported in the second paper were made in a special room, twelve feet square with a ten foot ceiling, for the purpose of determining the effect upon general illumination of reflection from side walls and ceiling. The paper seems to have been either hastily prepared or unduly condensed, as it is somewhat difficult to trace the practical bearing of the results obtained.

REGULATION AND ILLUMINATION, by Prof. L. B. Spinney; read before the Iowa Electrical Association, Sioux City, April 20.

The paper calls attention to the unreasonably large fluctuations in voltage delivered by some central stations, and states that many of them are unaware of the conditions that actually exist. In one case as much as 40 per cent. variation in candle-power of lamps within the 24 hours was observed.

DANGERS FROM ELECTRIC HEAD-LIGHTS; Address by Prof. Chas. H. Benjamin before the Western Railway Club, Chicago, April 19. Abstracted in the *Electrical World,* April 28.

Professor Benjamin reported the results of a series of tests recently conducted under the direction of the Indiana Railroad Commission by the Railway Engineering Department of Purdue University. The results proved unmistakably that the

electric headlight is a serious menace to the safety of railway transportation on which they are used.

The following is reprinted from the *Electrical World:*

As a result of these experiments it was found that an opposing electric headlight tended to obscure all signals, both those on the block towers and the classification signals carried by approaching trains. This interference was especially noticeable when any rain or fog was present. On the other hand, an oil headlight was found to obscure the various signals very slightly. With the electric headlight on their own car there were numerous instances of green lights being seen by the observers at short distances, when there was in reality no green light present. These phantom signals were probably due to light reflected back through the lens of an unlighted lamp, and were only noticeable with the powerful rays of the electric headlight. This phenomenon introduces an element of danger, in producing apparent safety signals where the real condition may be that of a danger signal extinguished. The observation of green rather than red phantom signals is explained by the prevalence of the short-wave lengths in the light from the electric head-lamp. This same effect of the electric arc was also seen in the greater obscuration of the green classification signals of passing trains.

Professor Benjamin believes that obstructions on the track cannot ordinarily be seen with an electric headlight to a sufficient distance to prevent the occurrence of accident. At the same time, an opposing headlight of this character, adjacent to block signals, so obscures them as to make it difficult to read them correctly at distances exceeding 100 ft. For opposing oil headlights, this distance was shown to be about 4000 ft.

In closing his remarks Professor Benjamin explained his conviction that the engineer and fireman of a train which carries an electric headlight are at a disadvantage in correctly reading signal lights, while on parallel tracks this objection is much increased, as the brilliant headlights from passing locomotives tend to obscure all signals. The greater illumination of the track ahead or of objects or obstacles thereon Professor Benjamin does not consider sufficient compensation for the disadvantages which his experiments showed for the electric headlight.

THE DISTRIBUTION OF ARTIFICIAL LIGHT, by Frank Marshall Scantlebury; a paper presented before the National Association of Cotton Manufacturers, Boston, April 28.

The paper is a review of the elementary facts in regard to electric lamps, reflectors, and illuminating engineeering, written so as to appeal to the layman.

Perhaps the most surprising thing in this connection is the apparent disregard of artificial lighting and the crude methods in existence in some of the big mills. It would surprise a good many people were they to know that some 50 large mills are using gas for illumination in New England alone, and were we to stop and consider that, with the improvements recently made in the electrical field, they could not only secure a much better light but could increase their efficiency 50 per cent. at a saving of about 25 per cent. in dollars and cents over gas, it will be difficult to understand why the illumination of yesterday is still in existence. . . .

There are, however, mills which monthly sacrifice thousands of dollars through sheer waste of illumination. It is a safe estimate that some $20,000,000 worth of illumination is wasted yearly in the United States alone, not as we might suppose by neglecting to extinguish the lights that are not in use or in other ways, but rather by the failure to control illumination. . . .

The best manner of illumination in textile mills has proven to be individual or group lighting from a large number of distributed small units, and it is for this reason that it has been dwelt upon more than on other schemes. Mill men are realizing more and more every day the vast importance of satisfactory artificial illumination, and it is a safe estimate that the best lighted mills in the world are found in the United States. However, there still remains plenty of room for improvement, although the strides made in this field within the last few years have been surprisingly great, but, within the next year, we will see developments that heretofore were undreamed of. . . .

American Items

Photometric Tests of Street Lighting in Budapest, by Francis Jehl; *Electrical World,* April 28.

The tests reported were made by an exceptionally impartial and competent committee, and are valuable and interesting as showing the illumination produced by a strictly modern installation according to European practice. The test was made on a street illuminated with Alba flaming arc lamps.

Additional interest attaches to the test from the fact that it included illumination by inverted gas arcs. Lamp posts were provided supporting three five-mantle lamps. The following is a summary of the results:

Type of lamp	Alba lamps, 3 in series, 110 volts, 15 amperes.			Inverted gas mantles.
Height of arc or burner from street level in meters	9.1	8.0	9.1	5.0
Distance of one lamp post from another in meters	35 and 48	35 and 48	35 and 52	22 and 34
Width of street in meters	29	29	33.5	34 36
Street area per lamp post in square meters	888	888	90	740
Consumption per lighting unit	550 watts, including resistance.			2025 liters per hour.
Consumption per 100 square meters of street area	62 watts.	62 watts.	61.8 watts.	274 liters per hour.
Consumption per lux and 100 square meters	7.32 watts.	7.24 watts.	10.52 watts.	28 liters per hour.
Mean horizontal intensity in luxes	8.45	8.55	5.88	9.78
Max. horizontal intensity in luxes	19.0	28.8	18.1	84.7
Min. horizontal intensity in luxes	2.5	2.39	2.05	1.64
Coefficient of distribution, max.-min.	7.6	12.1	8.8	51.6

Show Window Illumination, by J. R. Cravath; *The Central Station,* May.

A technical treatment of the subject, illustrated with diagrams.

A Difficult Lighting Problem, by Napoleon H. Boynton; *Building Management,* May.

The problem is the lighting of a book store, 30 x 100 ft. Just where the excessive difficulties of the problem come in will be a little difficult for the experienced illuminating engineer to appreciate. Whatever the difficulties were, the combination as installed seems to have solved them.

Effective Ways to Light Machinery, by R. N. Graham; *Factory,* May.

Shows different methods of lighting small machinery with individual units.

Reflectors for Incandescent Lamps, by Thomas W. Rolph; *The Electric Journal,* May.

A critical and analytical study of the subject of globes, shades and reflectors. Contains no new matter, but much useful information condensed into a few words.

Notes on Office Lighting, by C. E. Clewell; *The Electric Journal,* May.

The writer's conclusions are as follows:

These trials and numerous other experiments in offices of various sizes and heights

extending over a considerable length of time have led to the formation of a number of rules which can be applied in the satisfactory illumination of offices. In general, however, each office to be lighted should be given separate attention in the application of simple illumination principles, as in the choice of size of lamps and type of reflector. The attempt to apply a set rule for all cases without due care and study will often result in conditions far from satisfactory.

The following may be considered as general specifications for office lighting, based on the experiments as outlined above:

1. Small offices occupied by one man or by one man and an assistant should be treated as special cases. Usually one main light unit mounted high over the desk will be satisfactory.

2. Square offices up to, say, 14 ft. on a side and occupied by more than two persons, require a general overhead illumination of sufficient intensity to eliminate the necessity for individual desk lamps. Up to this limit four units arranged as indicated should be used, with the edge lamps about 3 ft. from the wall to take care of the desks along the wall.

3. Square offices from about 14 to 22 ft. on a side should be equipped with nine units arranged as indicated, edge lamps to be about 3 ft. from the wall.

4. Square offices from about 22 to 30 ft. on a side may advantageously be equipped with 16 units arranged symmetrically as in the foregoing cases, the edge lamps to be about 3 ft. from the wall.

IMPROVEMENTS IN STREET LIGHTING UNITS, by Dudley A. Bowen; *The Electric Journal*, May.

A description of the Westinghouse metallic flame arc lamp.

THE LATEST IMPROVEMENT IN NERNST LAMPS, by A. E. Flemming; *Electrical News* (Toronto), May.

Gives diagrams, illustrations and photometric curves of the latest forms of Nernst lamps.

ORNAMENTAL CONCRETE STANDARDS FOR BRIDGE LIGHTING, by Charles L. Eshleman; *Concrete Engineering;* reprinted in the *Architect and Engineer,* April.

An illustrated article showing the details of a number of concrete lamp standards and posts.

GAS LAMP MAINTENANCE AND SELLING METHODS, by Alfred R. Burr; *Progressive Age,* May 2.

Gives the experiences on this subject of the New Haven Gas Light Company.

Foreign Items

COMPILED BY J. S. DOW

ILLUMINATION AND PHOTOMETRY.

THE MEASUREMENT OF LIGHT AND ILLUMINATION (Discussion at a meeting of the Illuminating Engineering Society, London, on April 14).

At this meeting the discussion on the above subject originated at the previous meeting of the society on March 15 was continued. On this occasion the more practical aspects of the subject were dealt with. Demonstrations of the use of illumination photometers were given by Mr. A. P. Trotter and Mr. Haydn T. Harrison, and Mr. P. J. Waldram exhibited the special attachment used with the Trotter instrument for measuring the daylight illumination in interiors. Mr. L. Wild discussed the sensitiveness of different forms of photometers and showed a new instrument utilizing a silvered-mirror screen, somewhat on the principle of the Lummer-Brodhun, for which exceptional sensitiveness was claimed.

An interesting communication was also presented by Dr. W. E. Sumpner, in which the theory of the Ulbricht globe photometer was discussed and the possibility suggested of replacing the globe by a cubical box. On theoretical grounds the author considers that such an arrangement would be quite as accurate and much more convenient to manufacture. Much of the discussion at this meeting turned on the best methods of measuring street and interior illumination, *e.g.,* whether in a vertical or horizontal plane, etc. Mr. J. G. Clark, on the other hand, contended that,

having once determined the illumination it was most convenient to concentrate attention on the sources themselves and to see that their illuminating capacity was not diminished, in preference to making periodic measurements of the illumination available. The same speaker described the use of the Simmance Abady street photometer.

(The above meeting is referred to in a number of technical journals in London, *e.g., J. G. L.*, April 19, *Electrician*, April 22; *Elec. Times*, April 21, etc.).

THE MEASUREMENT OF LIGHT AND ILLUMINATION (Discussion at the meeting of the Illuminating Engineering Society on March 15).

This was referred to in the last review. The complete account of the discussion is now published in the *Illuminating Engineer*, London, April, 1910.

SOME PRACTICAL ASPECTS OF RADIATION, by J. G. Clark (*J. G. L.*, April 26).

The paper deals very largely with thermometry and questions of heat generation and measurement. Reference is also made to the distribution of light from sources, and polar curves are given for incandescent gas mantles equipped with various types of opal shades, etc.

THE DISTRIBUTION OF ENERGY IN THE SPECTRA OF ARTIFICIAL ILLUMINANTS, by W. W. Coblentz (*Illum. Eng.*, London, April).

The author continues his analysis of the radiation from different illuminants. In the present installment he deals with luminous flames and luminescent gases. The latter are represented by the mercury arc.

ILLUMINATION, ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter (*Illum. Eng.*, London, April, 1910).

Describes the most recent type of Harrison illumination-photometer.

SHOP AND SHOW WINDOW LIGHTING (*Elec. Field*, April).

The author enters into a detailed analysis of the functions of light intended for shop-window-display. He recommends that a source should never be installed without a clear conception of the purpose for which it is intended. For instance, lamps are sometimes used for purely advertising purposes, and in other cases with the object of illuminating the goods in the window. These two distinct objects must not be confused with one another. Otherwise we are apt to get "dazzle." The most effective methods of shop-window-display in general utilize lights which are themselves concealed from view.

VORSCHRIFTEN FUR DIE MESSUNG DER MITTLEREN HORIZONTALEN LICHTSTARKE VON GLUHLAMPEN (*E. T. Z.*, March 24).

Summarizes the recommendations of "Verband Deutscher Elektrotechniker" regarding the measurement of the mean horizontal candle power of glow lamps. The lamp should, if possible, be rotated at a suitable speed. When this is not possible, however, it may be maintained stationary and a mirror rotated round it (Brodhun method). Two photometrical processes for the actual comparison on the photometric bench are given.

STREET LIGHTING 100 YEARS AGO (*Copartnership Journal*, April).

DAS BELEUCHTUNGSWESEN IN ITALIEN (*Z. f. B.*, April 10).

DIE MESSUNG DES GLANZES (*Z. f. B.*, March 30).

ILLUMINATING VIEWS ON PHOTOMETRY AND ILLUMINATING ENGINEERING IN AMERICA (*J. G. L.*, March 29, April 5).

THE MEASUREMENT OF MEAN SPHERICAL CANDLE POWER (*Illum. Eng.*, London, April).

ELECTRIC LIGHTING.

THE BLACKENING OF METAL FILAMENT LAMPS, by G. B. Barham (*Elec. Times*, March 24).

THE PROGRESSIVE ELECTRICAL CONTRACTOR (*Elec. Review*, April 1).

A striking editorial illustrating how the point of view with regard to the functions of the illuminating engineer has changed of recent years. It is suggested here that the illuminating engineer may very well find a field of action in scheming out in-

stallations, the contractor being the man who carries them out. Under the conditions the advice of the consulting illuminating engineer will be needed, but there is every reason for the contractor also to study illuminating engineering in order to carry out the work satisfactorily.

THE APPLICATION OF METALLIC ELECTRODES TO ARC LAMPS, by B. Monasch (*Illum. Eng.*, London, April).

The author summarizes the previous work that has been done in this field referring to experiments with arcs struck between Nernst filaments, etc. He also describes some experiments of his own with mixtures of various metals with magnetite, finding that the metal titanium is very satisfactory as a means of adding to the light produced in the arc.

DAS WIEDERANZUNDEH DES KOHLENBOGENS, by I. A. Pollock and E. M. Wellisch (*Z. f. B.*, April 20).

Describes some experiments on the duration of time during which the current can be withdrawn from an electric arc between carbon electrodes without its going out. Curves are presented showing the connection between the voltage applied across the arc and the time.

FORTSCHRITTE IN DER GLUHLAMPEN INDUSTRIE (*Z. f. B.*, March 30-April 10).

PATENTBERICHTE: ELEKTRISCHE BELEUCHTUNG (*Elek. u. Masch*, April 3).

The above two articles deal mainly with recent patent literature on the subject of electric lamps. The first is devoted to processes for winding and connecting metallic filaments. The second is of a general character.

TUNGSTEN LAMPS WITH DRAWN FILAMENTS (*Elec. Times*, April 7).

Refers to the new lamp brought out by Siemens in which a filament of drawn tungsten wire is used. The lamp is claimed to consume only one watt per candle and to be much less liable to breakage than the ordinary tungsten lamps.

NORMALIEN FUR LAMPENFUSSE UND FASSUNGEN MIT EDISON—GOLIATH-GEWINDE KONTAKT (*E. T. Z.*, March 31).

A SHORT FLAME ARC (*Elec. Review*, April 8).

GAS, OIL, ACETYLENE LIGHTING, ETC.

THE PUBLIC LIGHTING OF WESTMINSTER (*J. G. L.*, April 19; *Elec. Times*, April 21; *Electrician*, April 22, 29).

An event of considerable interest in connection with gas lighting has been the decision of the Westminster street lighting committee to light the locality in the neighborhood of Picadilly (one of the most important and busy parts of London and the heart of the theater district) by high pressure and inverted incandescent gas lamps. The streets in this neighborhood have hitherto been lighted by electric arc lamps. An interesting precedent is the imposition of a penalty of 5s. per lamp in the event of its not giving the stated candle power.

THE GAS COMPANIES STANDARD, by Burner Bill (*J. G. L.*, April 12, 19; *G. W.*, April 16).

Much discussion still takes place regarding the bill now before Parliament for the establishment of a single testing burner for gas companies instead of the present very chaotic conditions. The possibility of prescribing both a calorific and an illuminating standard is also undergoing consideration.

AUTOMATIC LIGHTING AND EXTINGUISHING OF GAS LAMPS (*J. G. L.*, April; March 29).

A USEFUL TRADE SHOW ROOM (*J. G. L.*, April 19).

THE STANDARD AUTOMATIC GAS CONTROLLER (*G. W.*, April 2).

LIGHTING GAS LAMPS IN THE STREET BY WIRELESS ELECTRICAL IMPULSES (*G. W.*, March 12).

The above notes all deal with trade novelties chiefly in connection with distance gas lighting.

The "Gascho" simple controller and the Broadberry apparatus are described. Both of these devices act on a wave of

pressure from the gas works. The former utilizes a small cog-wheel actuated by a brass lever, which is in turn caused to rise by the pressure of gas in a leather vessel. The latter uses liquids, a special feature being the provision of artificial inertia which prevents the apparatus being affected by a transient fluctuation in pressure, although it responds to a steady impulse.

A note in the *Gas World* (March 12) refers to a suggestion in Germany that lamps might be lighted and extinguished in the streets by means of a wireless electrical impulse.

Eclairage de Secours dans les Theaters de Paris au Moyen de l'Acetylene Dissous, by P. Rosemberg (*Rev. des Eclairages,* March 30).

Refers to the recent decision of the police authorities in Paris to recognize dissolved acetylene as an emergency system of lighting in theaters. The portable nature of the system is claimed to render it particularly acceptable for this purpose.

L'Eclairage a l'Acetylene au Moyen de Lampes Intensives, by H. Gallus (*Rev. des Eclairages,* March 30).

Describes the value of powerful acetylene lamps for the illumination of buildings during erection, for unloading ships by night, etc., and in all cases in which the source must be capable of being moved from place to place and gas and electricity are not available.

Gas Combustion and Test Burners, by W. Grafton (*J. G. L.,* April 5; *G. W.,* April 9).

Richerche Sull'effetto dei Riflettori Applicati alle Lampade ad Incandescenza a Gaz Rovesciate e Diritte, by J. G. Wobbe (*Il. Gaz.,* March).

Ein Neuer Laternenmast, by H. Wunderlich (*J. f. G.,* April 16).

Acetylene, the Best Light for the Eyes (*Acetylene,* April).

Petrol Gas Machines from the Standpoint of Safety (*Acetylene,* April).

Petrol Air Gas (*Gas World,* April 16).

Innovations in Acetylene Inverted Lighting (*Acetylene,* April).

Neue Invertbrenner (*Z. f. B.,* April 10).

Die Neue Gratzin-Spiritus-Gluhlichtlampe (*Z. f. B.,* April 10).

Gluhlampen fur Flussige Brennstoff; Dochtlampen (*Z. f. B.,* April 20).

Contractions used:
Elek. u. Masch. Elektrotechnik und Maschinenbau.
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World.
Illum. Eng. Lond. Illuminating Engineer of London.
J. G. L. Journal of Gaslighting.
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
Z f. B. Zeitschrift für Beleuchtungswesen.

The
Illuminating Engineer

Vol. V JULY, 1910 No. 5

LET THERE BE MORE AND BETTER LIGHT

We have said, "Let there be more light," and there IS more light. Two lamps are shining where but one shone before, and one is shining where formerly there was none.

There are many dark places yet to be lighted; but while the demand for more light has by no means lost its force, nor is likely to in our time, the demand for better light at present is at least as urgent, and perhaps even more so, than the demand for more light.

The cheapening of any commodity always increases its use, and the revolutionary improvements in the efficiency of all artificial light-sources have resulted, in the natural course of things, in the use of light in much greater quantities than formerly. The standard of illumination, measured in mere quantity or intensity, has been continually raised.

With one or two exceptions, the increase in efficiency of light-sources has been accompanied by a corresponding increase in brightness, or intrinsic brilliancy. This necessitates an equal increase in precautions against the improper use of the light. While the essential facts of illuminating engineering have spread with remarkable rapidity since the foundation of the science, they have not kept pace with the remarkable increase in the use of light.

The all-important thing that now needs attention is to secure the best QUALITY of illumination from these modern light-sources. Evil is good misapplied or perverted; the greater the good, the worse the evil when perverted. It is the sweetest cider that makes the sourest vinegar; and the brightest light gives the worst illumination when improperly used.

Eyes and nerves are immeasurably more valuable than gas and electric current; and the efficiency and comfort which illumination secures for the user is the final test of its worth.

Let us no longer ask, What does this light cost? but, What is the best illumination that can be procured from it? If modern light-sources do not secure a higher measure of human comfort and satisfaction they had better never have been discovered.

"Let us have more and BETTER light."

E. L. Elliott.

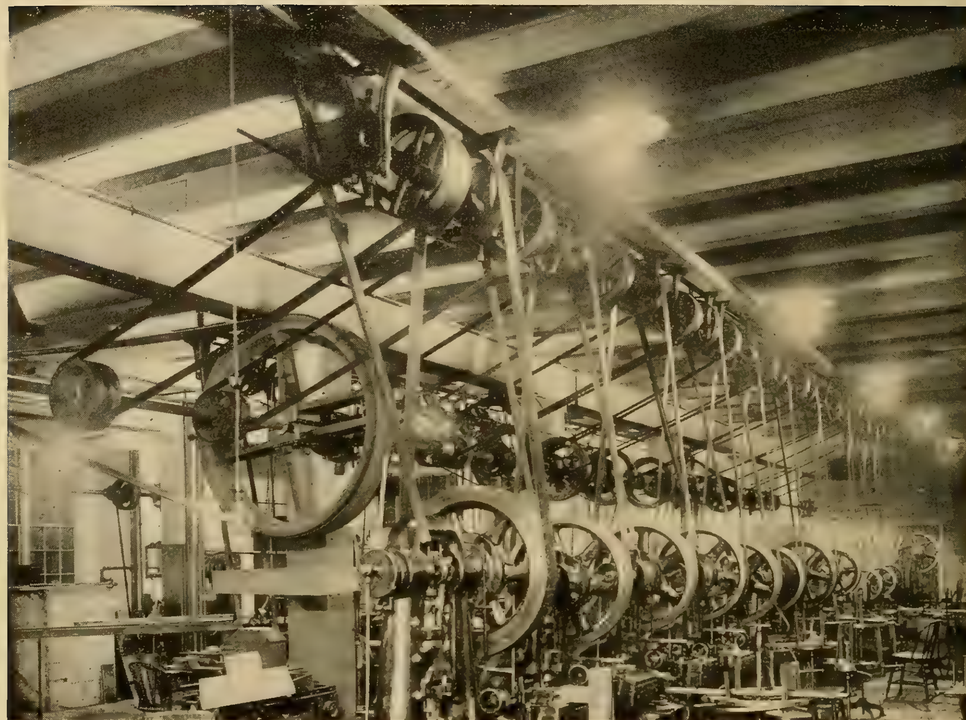


FIG. I.—SECTION OF PRESSROOM, SHOWING EFFECT OF THE NEW TUNGSTEN INSTALLATION.

Industrial Lighting With Tungsten Lamps

By H. H. Skinner.

While fairly adequate illumination has been possible for industrial plants by the use of carbon filament and arc lamps for the past 25 years, it is doubtless true that the unusual attention attracted to the subject of lighting in general by the advent of the tungsten lamp has been largely responsible for the recent awakening to the importance of illumination in the manufacturing industries. Undoubtedly, also, this new form of lamp offers some marked advantages over other illuminants for this purpose. It possesses the advantage over the arc lamp of perfect steadiness, and over the carbon filament lamp of better color and greater efficiency, while having the general advantage of being made in large units, and of being comparatively inexpensive to install, and requiring little attention in operation.

New England has long been celebrated for the great diversity of its manufactured products. It is said of some of our cities that they " make everything from a sewing needle to a locomotive," a characterization which is often almost literally true. Providence has one of the oldest of the locomotive works, as well as innumerable factories turning out fine machinery and small articles. Few of us stop to think, when we are chasing the elusive collar button in its mad whirl into some inscrutable corner, where all of the collar buttons are made. In fact, we rarely stop to consider whether they are made at all; they seem a sort of natural product. Nevertheless their manufacture is an industry of no little importance, and one requiring much skill and considerable equipment in its conduct. The connection between collar buttons and curtain rods is certainly not of the most obvious

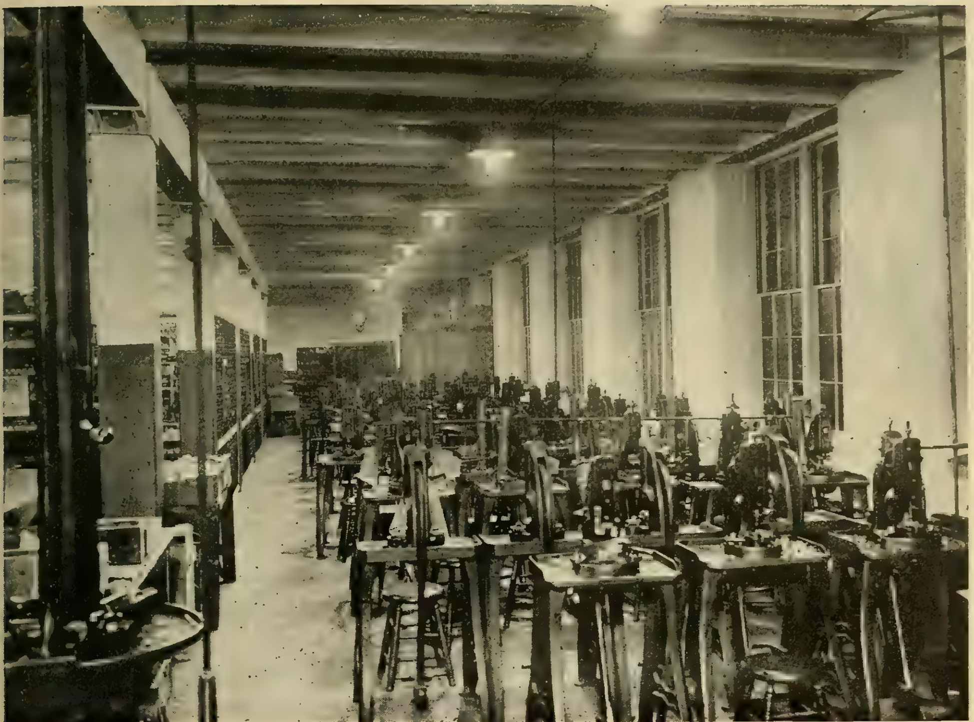


FIG. 2.—FOOT POWER PRESSROOM.

FIG. 3.—SCREW MACHINE DEPARTMENT.

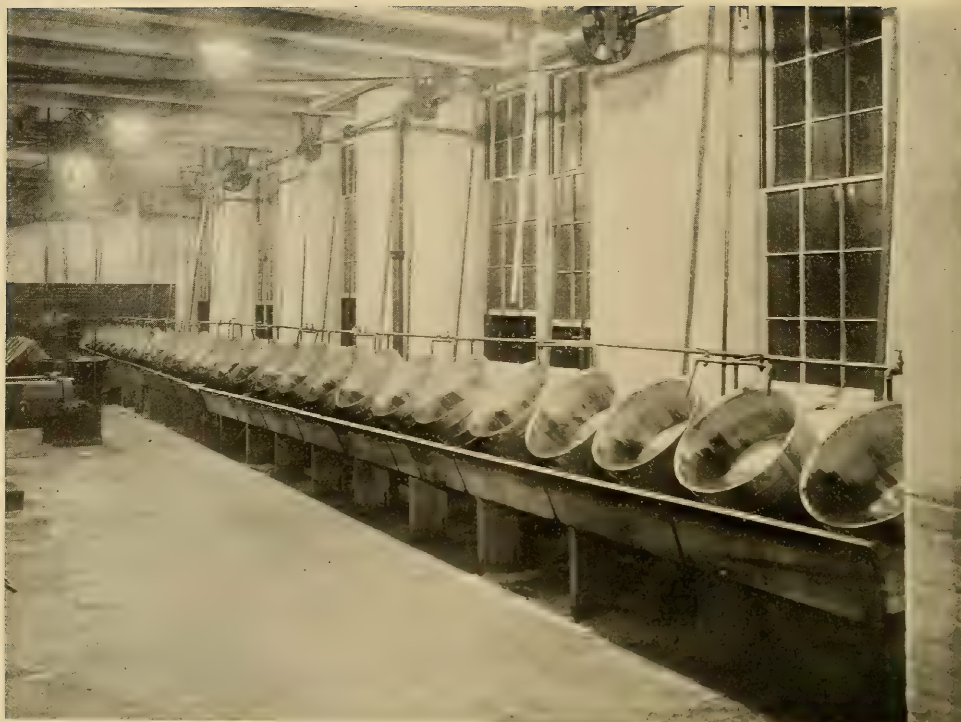


FIG. 4.—FINISHING DEPARTMENT.

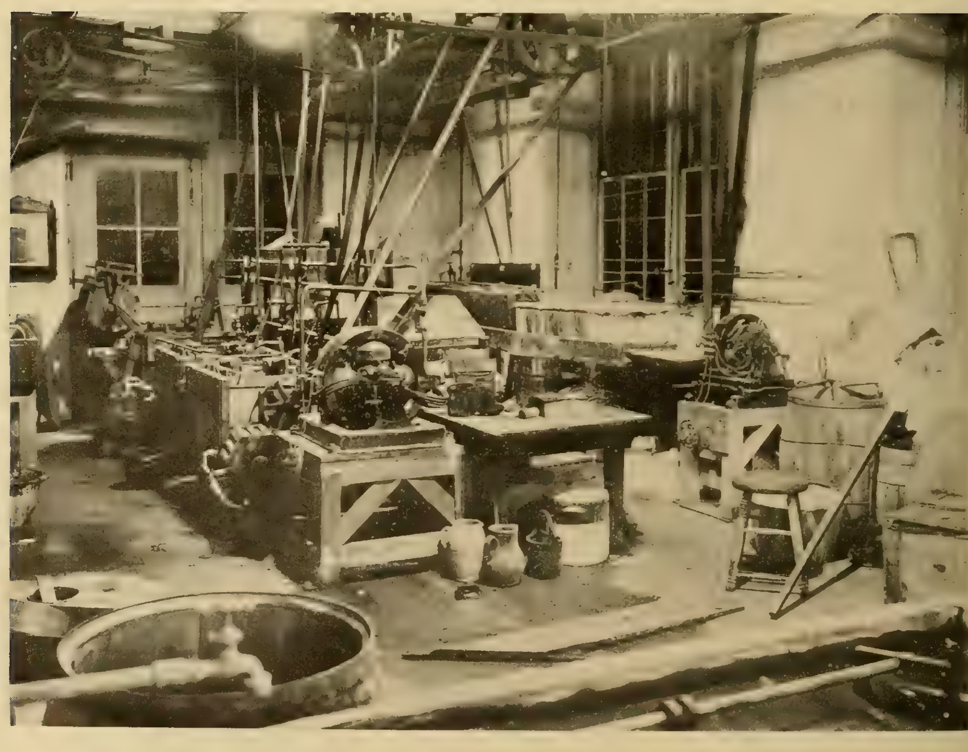


FIG. 5.—PLATING DEPARTMENT.

nature, and one would hardly expect to find them springing from the same plant. But such is the case in the particular instance which we are about to examine.

The factory in question occupies two floors and the basement of a new building of modern mill construction. The supporting columns for the floors divide the space into bays 12 x 16 ft., each having, therefore, an area of 192 sq. ft. The lighting installation consists of single 180-watt, large bulb, 250-volt tungsten lamps, with a shallow white enameled reflector suspended in the center of each bay, 11 ft. above the floor.

Fig. 1 shows a section of the press room. This work requires an especially good illumination in order to clearly see the bright metallic surfaces, and to avoid all possible danger of accidents. The illustration is from a photograph taken entirely by the artificial lighting, as are all the others shown in this article; proof of this is evident in the windows, which show black. The clearness with which all the parts of the machinery can be seen and the absence of black or confusing shadows furnishes a very fair basis by which to judge of the quality of illumination furnished.

Fig. 2 is a view of a foot-power press room, in which the same general characteristics of illumination are observable, and in which the same general requirements prevail.

Fig. 3 shows a section of the screw machine room. The absence of dark shadows is particularly notable here.

Fig. 4 is a view of the finishing room, showing the tumbling barrels, in which the collar buttons and small parts are polished. The perfect uniformity of illumination here is particularly noticeable.

Fig. 5 shows the plating room. The greater whiteness of the light of the tungsten lamp comes into use here, since color is an important part in the final finish of the goods.

Fig. 6 shows a machine room in the curtain rod department, where the illumination is such as to afford as good facili-

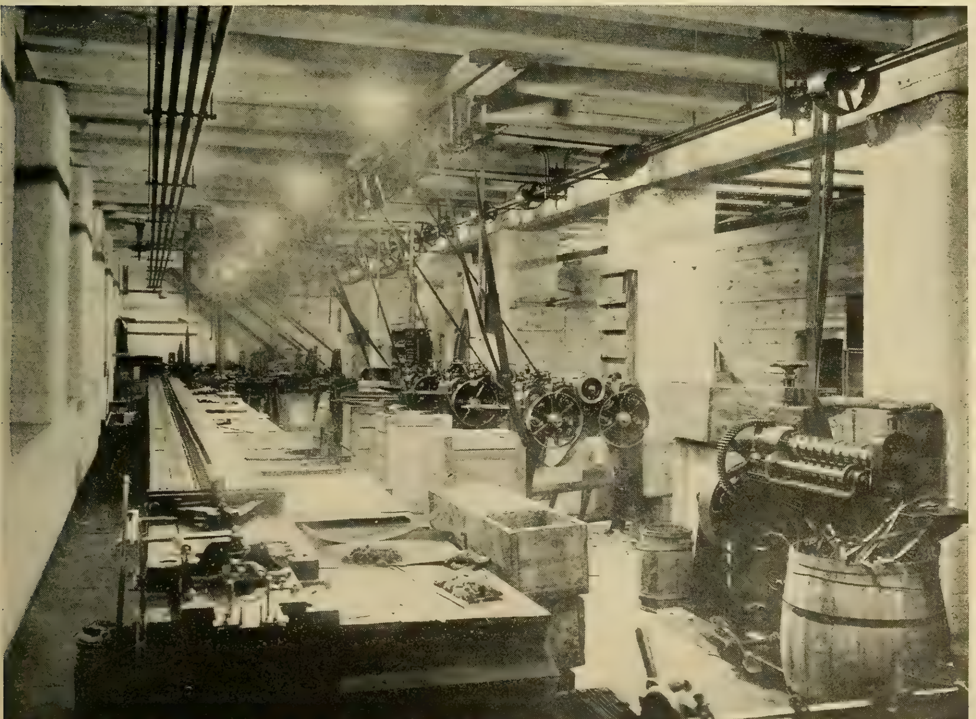


FIG. 6.—MACHINE ROOM IN CURTAIN ROD DEPARTMENT.

FIG. 7.—SECTION OF ONE OF THE OFFICES.

ties for work as obtained under ordinary daylight conditions, and better than exists in many of the older factories.

Fig. 7 is a view of one of the offices in which general illumination is used exclusively. It is found that this method of lighting is quite as satisfactory as the method with individual lamps, with the advantage that the tables are entirely free of incumbrances of this kind.

The curtain rod department of this factory will run night and day continuously hereafter; hence the additional importance of providing the best possible illumination. During the hour following the workman's midnight lunch a feeling of lethargy creeps over him, which only exercise and brilliant light can overcome. A dimly lighted room for all night work is a handicap to the workman in more ways than the mere difficulty experienced in seeing. This is the result of my own experience and observation, and of many others whom I have questioned on the subject.

From the engineering viewpoint the fact that the tungsten lamp has been found entirely satisfactory in respect to life in the press room, where presses were working both above and below them, is an especially noteworthy fact, showing that the filaments have ample mechanical strength to withstand even the excessive jar and vibration incident to this position.

The illumination on a plane 3 ft. above the floor is theoretically 3.75 foot-candles, and is obtained at an expenditure of .94 watts per square foot of area.

At the time the photographs were taken the lamps were heavily coated with an accumulation of dust, which leads me to believe that the loss of light from this source is not as severe as opinions that have been expressed on the subject would lead one to believe. Plain enameled shades were used, for the reason that they are easy to keep clean, and thus lessen the maintenance cost. The drop lights which are shown in the photographs were for temporary use, and have since been removed.

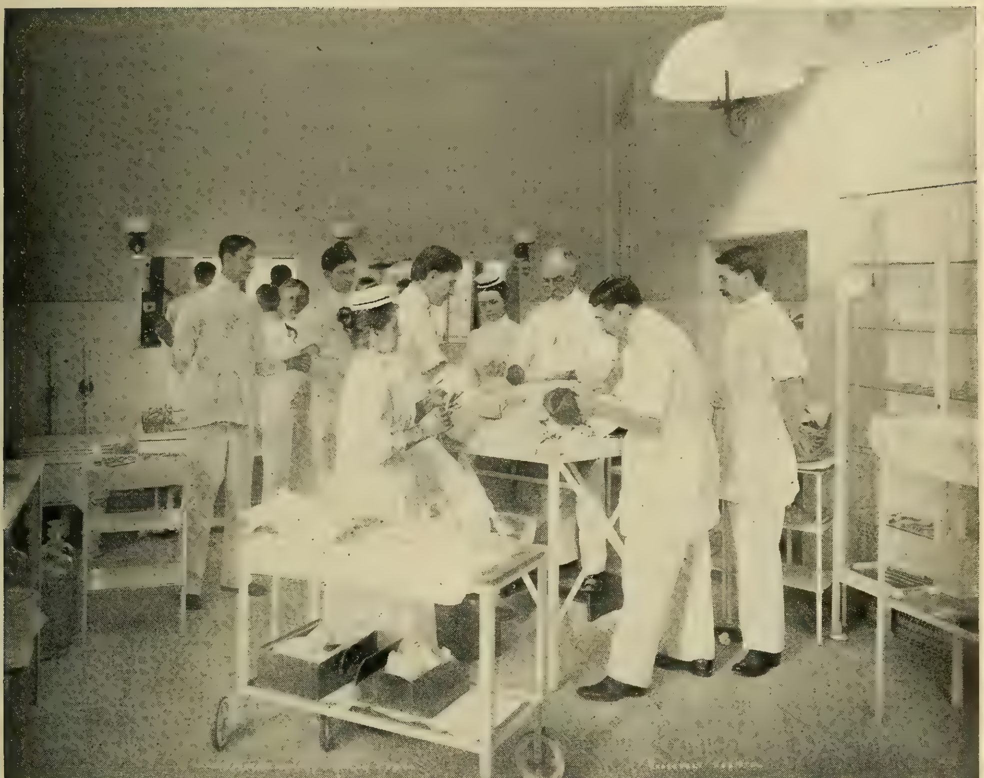


FIG. I.—READY FOR THE OPERATION.

Hospital Lighting

II.

Considering the rapid progress that has been made along all the lines of applied science, it is not surprising that there should be found frequent cases where the new has been grafted on to the old in a more or less bungling and makeshift manner. A factory makes money, and its equipment with the most modern appliances is, therefore, essential to its commercial life; but a hospital is only a place where the poor human body is patched up and remodeled, and, as there is nothing so cheap as human life, we can hardly look for the immediate adoption of new and more or less expensive appliances.

Of all the relics of obsolete equipment the artificial lighting seems to be the survival of the unfittest. While patients are spared a temperature range which would leave them shivering in winter and suffocating in summer, they are far more often than otherwise ruthlessly exposed to the nerve-racking strain of dazzling and ill-directed artificial light. The makeshift methods which still prevail are nowhere more forcibly illustrated than in the illumination of operating pavilions, a place in which the importance of good light is too self-evident to need comment.

Fig. 1 shows an operating room in one of the older New York hospitals. The picture is of special human interest in showing an actual operation, the operating surgeon being one of national reputation.

Fig. 2 is a view of the same room unoccupied. The illumination here is a combination of gas and electricity, and is

undoubtedly a relic of the days when it was considered necessary to provide gas as an emergency light in case the electric current should fail. The gas fixtures apparently antedate the general use of mantle burner, as the fixture consists of four plain flame tips. Electric light is supplied by a cluster of carbon filament lamps, placed within a large dome-shaped opal reflector. As 32-cp. lamps were undoubtedly used, the illumination from this source was undoubtedly fairly satisfactory before the days of the tungsten lamp. At the present time a cluster of three or four tungstens would, of course, be used in place of the carbon filament lamps, while a single inverted gas lamp would take the place of the old tips.

Fig. 3 shows an operating room of manifestly modern equipment. The lighting fixture is shown as a large rectangular canopy of opal glass covering 10 carbon filament lamps, four on either side and one at each end. It is also supplied with the same number of flame gas jets around the outside. While this was a fairly efficient device in its time, it is a "back number" now. Four tungsten lamps placed in a vertical position in the apex of the reflector would bring it up to date. While gas flames are even more antiquated than the carbon filament lamps the chance of their being required for use is so remote as to render them of little account. To make this fixture strictly modern, however, it would be a simple matter to place an inverted mantle burner at each end of the fixture.

Fig. 4 shows another operating room of modern construction. The lighting fixture here, however, is less defensible. The large central reflector is intended for use only with the row of gas jets beneath, which means that it is practically useless. The circle of eight incandescent lamps with opal reflectors is a poor arrangement compared with the present possibilities. The lamps are placed as low as possible, and hence just out of reach of the head of the operator. A single lamp with a re-

FIG. 2.—OPERATING ROOM SHOWN IN FIG. I. EVERYTHING MODERN BUT THE LIGHTING.

FIG. 3.—A LIGHTING DEVICE THAT COULD BE EASILY MODERNIZED WITH TUNGSTEN LAMPS.

FIG. 4.—A NEW FIXTURE IS THE ONLY RIGHT SOLUTION IN THIS CASE.

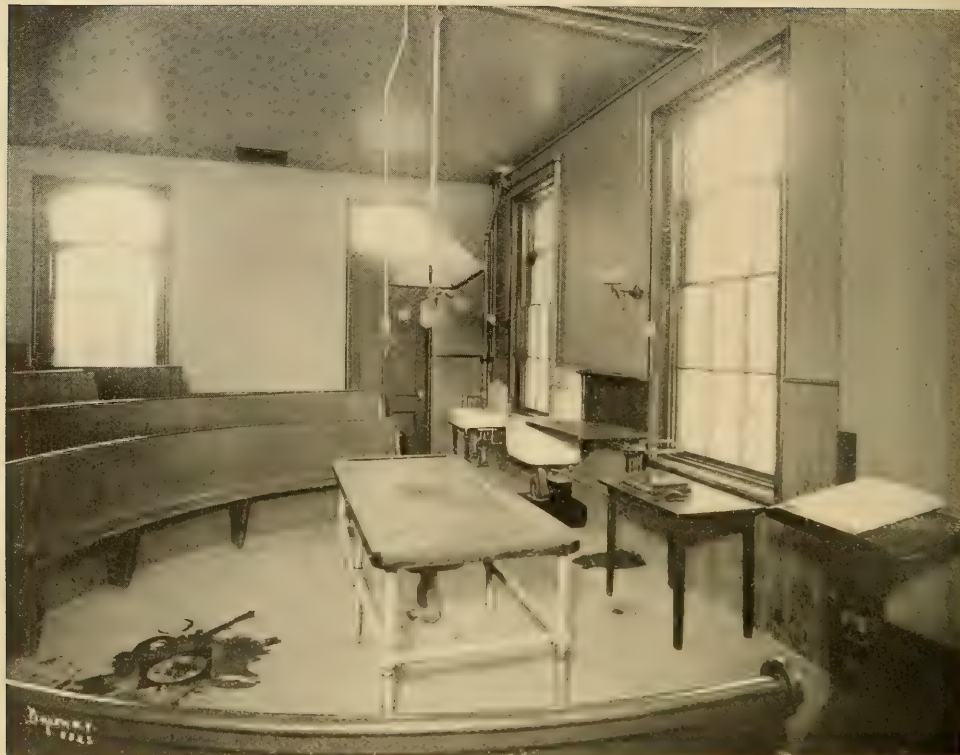


FIG. 5.—A MAKE-SHIFT FIXTURE IN A DISSECTING ROOM.

flector on a movable stand is an excellent piece of apparatus for additional and special lighting. The worst feature of this installation is that all lamps have clear bulbs and are so distributed that some of them must be in the line of vision in whatever direction the eye happens to rest. The only right way to remedy this installation is to remove the central fixture and replace it with a modern device, although the central reflector might be retained and fitted with a tungsten cluster at the top. Frosted lamps should replace the clear bulbs on the side brackets.

Fig. 5 shows a dissecting room. It is a wonder that some of the subjects operated upon do not rise up from death in protest against the illumination here furnished. Probably the central lighting fixture here was originally intended for gas, which may account for the sprawling collection of electric lamps well out of reach of any possible interference from reflection. This is a fair example of the abuse of illumination by sheer ignorance and carelessness. To be sure, dead men tell no tales, and see no lights; but the benches plainly indicate that the room is intended as a demonstration room, and the eyes of the speakers, to say nothing of the demonstrator, are certainly of some account.

The slight expense and trouble which would be entailed in bringing any of the illustrations here shown up to the best possible conditions in the present state of the lighting art is so relatively small that there can be no sufficient excuse for neglect

It is this general neglect, and this very condition, that brought into existence the profession and the science of illuminating engineering. Every hospital should at once be examined by at least one competent illuminating engineer, and preferably by a board of three or more, so that needless faults and misuse of artificial light might be as speedily corrected as possible.

From Torch to Civilized Lighting

By G. Brewer Griffin.

When man lurked in caves and dressed in the skins of wild beasts, slain by the blow of a stone or club, and ate uncooked food, is it to be wondered at that sun worship was the leading religion, considering that the best artificial light known to primitive man was the fitful red glare of a blazing stick of resinous wood he carried in his hand to light his way through the pagan night, or the flame of the wood fire he lighted to keep away the prowling beasts of prey?

They believed the light to be the power of good and darkness the power of evil, and that every 12 hours or so these two powers engaged each other in a battle for supremacy; therefore they offered sacrifices for the love of one and for fear of the other. Their days were spent in a state of thankful fear and their nights in a sort of howling misery, gilded by a ray of hope for the morrow.

A hundred generations of their posterity has not succeeded in *totally* wiping out the slight trace of this fear of darkness, which still exists in the undeveloped mind of civilized childhood.

The Egyptian or the Chinaman who invented the olive or peanut oil lamp, crude as it was, proved a benefactor of the human race. From it all types of fluid fuel lamps have been developed. Although the Esquimaux of the Far North still uses his blubber lamp or a torch consisting of a species of oily, dried fish, stuffed with moss, and the African savage of the Far South still builds his wood fire by rubbing two sticks together and brandishes his blazing brand, it is because they have not advanced far enough in the scale of human development to require the necessities of civilization. It may be said that the world power of a race of people may be judged by the type of artificial light used by them.

The candle was considered good enough until the advent of the sperm oil lamp, which soon gave place to the so-called "patent fluid," which was in turn displaced by the petroleum oil lamp. Therefore, petroleum or kerosene oil lamps were and are still used by the greater class of those whom Lincoln loved to refer to as "the common people."

The "Voltaic Pile" was exhibited by Alex. Volta in March, 1800. By the adoption of the principles laid down by Volta, Humphry Davy, then a man of 22, began, in February, 1801, to construct a battery of voltaic piles (250 pairs), by the use of which he discovered a new metal, potassium, and later sodium. During 1808 and 1810 he arranged and exhibited before the Royal Institution of London a bank of 2000 zinc and copper cells 32 inches square in 200 porcelain troughs, the active solution being composed of water 60 parts, nitric acid 1 part, sulphuric acid 1 part. From this battery the first flashes of electric light were obtained in 1810. During the experiment charcoal points were used. For 34 years this brilliant laboratory experiment produced no practical results.

Commercial electric illumination was made possible in 1831 by Faraday's discovery of the principle of electro-magnetic induction. A year later Pixii constructed the first magneto-electric machine. From this time on one improvement followed another. The most noteworthy advance between 1832 and 1866 was the invention of the Siemens armature and the use of it by Wilde in a machine which may be said to contain the germ of the modern machine of to-day.

In 1844 Leon Foucault, with the use of gas retort carbon and the recently discovered "Bunsen" battery, succeeded in producing a steady, continuous arc. The first arc lamp was patented by Thomas Wright, of Thames Dilton, England, in 1845.

The manufacture of illuminating gas from coal became commercially possible in the United States about 1849-50, but, owing to the expense of distribution, it was available as an illuminant only to the comparatively wealthy, who resided in fairly large towns or cities.

From 1840 to 1859 many patents (about 20) were taken out on arc lamps, chiefly those controlled by clockwork mechanism. About the latter date in-

ventors, with few exceptions, abandoned the work, seemingly thinking that the field of service was not extensive. For a period of 12 years following 1859 no improvements in existing lamps were patented.

During 1874 and up to the advent of the American Brush Machine and lamps hundreds of lamps, more or less complex, impractical or inoperative, were patented abroad. From the time of the advent of the Brush apparatus the United States at once took the lead in the development of the commercial arc lamp.

In arc lamp construction Brush, Weston, Sheridan, Wood and others from 1879 set a pace hard for Europeans to follow, as their design was at once simple, practical and successful in operation. This pace has continued ever since and the American inventor to-day stands preeminent in this line.

When a current is passed through a conductor there is a loss between the source of supply and the point of delivery, due to resistance. The greater the resistance offered by a conductor to the passage of current, the greater is the heat generated (the resistance varies directly as the length, and inversely as the cross section. The heat will vary in the same proportion). As the temperature is raised the resistance of metals is usually increased and liquids decreased. Poor conductors of electricity, whether solid or liquid, offer less resistance as the temperature increases. Carbon belongs to the last mentioned class, although it has a slight diminution in resistance, being about 3/10,000 for each degree between 26 degrees and 270 degrees Cent. (as shown by Borgman's experiments).

With current on, it is necessary to make a momentary contact between carbons or other active elements to establish the arc. When once established they may be separated by a short air space without extinguishing the arc, but rather adding to its intensity. Explanation: The temperature of the electric arc is about the boiling point of carbon, thus carbon vapor has a comparatively high resistance, but nevertheless serves as a path for the retransmission of the current generated by self-induction of the arc, which has e. m. f. sufficient to pass or jump the interpolar space represented by the arc itself. The arc is a phenomenon of conduction, an integral part of the current governed by the same laws as any other part of the circuit.

This being of necessity a sketchy outline of the history of electric lighting development, the writer cannot enter into a description of the many types of open arc lamps which were developed during this period and preceding the introduction of the enclosed arc, on which patents were granted to Louis B. Marks, of New York City, in 1894. Were I to do so several hundred pages would be required to do the matter even partial justice. Suffice it to state that at this time the electric arc lighting of streets, stores, etc., was common practice in the United States even more than it was abroad.

It may be of interest to state that the Westinghouse Electric & Manufacturing Company, then a comparatively small concern in Pittsburgh, Pennsylvania, had at a considerable period prior to the above date a very creditable open arc lamp. That company being the first to use lamps in series on alternating current, they had made some crude experiments with a view of steadying the light and prolonged the life per trim of carbons by partial enclosure. These experiments were not followed up, owing to rapid development in other branches of the business, which appeared to be of greater importance and more pressing need. In any event, Marks produced the first commercially successful enclosed arc lamps, and, while the validity of his patent has been questioned by a few, it has been maintained by the courts.

So rapid has been the adoption of the enclosed type, the open type arc lamp is *almost* a curiosity at this writing in cities of the first and second class. Although still in service in many localities, they are being rapidly displaced for street lighting by their successor and superior, the enclosed arc, and that in turn by the latest member of the arc lamp family, the metallic flame or luminous arc lamp.

All of these lamps have reached a high point of excellence as used in American practice, which has ruthlessly weeded out "freaks" and settled upon an arrangement of active elements consisting of one pair, placed in line vertically, the longer being the upper and the shorter the lower,

the arc being established between them in an enclosing bulb of glass, in the case of carbon enclosed lamps, which is, in turn, partially enclosed by an outer globe of glass, this arrangement giving a steadiness of light and life per trim undreamed of 10 years ago. By it arc lighting has become popular for many indoor lighting services for which the open arc lamp was totally unfitted. The cost of operation to the user has been reduced in ratio as the cost to the producer has been lowered.

The present day tendency is to recognize more and more that proper sources of light and the distribution from these sources is one of the very best forms of advertising. Civic pride has made illumination necessary, and the idea gained by the traveler passing through a city or town in the evening on a railroad train or otherwise is largely based on the manner in which its streets are lighted; thus the more light and the higher its character, the better will be the traveler's opinion of the locality.

Now that the automobile is the common means of transporting travelers for pleasure and other purposes, well lighted streets are almost essential to avoid accidents and to give the drivers a clear view of the roadway.

In congested districts it is common knowledge that the people congregate mostly on the streets which have the best lighting and purchase from the stores which present the most attractive appearance, which appearance is greatly enhanced by sufficient and proper illumination.

One of the striking acknowledgments of the value of proper illumination is the tendency of Business Men's Clubs in the various cities to demand that the downtown sections shall be illuminated to a considerably greater extent than heretofore and by their insistance that only the latest form of lighting devices shall be adopted. Witness the efforts of this kind in Los Angeles, Cal.; St. Louis, Mo.; Newark, N. J.; Boston, Mass.; Minneapolis, Minn., and other promising wide-awake cities.

The advent of the tungsten lamp has made it possible for municipalities to purchase more light and for the central stations to supply it at lower cost than previous to this time has been possible, which has brought about improved lighting on second class streets and alley-ways whose gloomy depths of darkness have made necessary in the past a larger police force than would be necessary if such highways were sufficiently well illuminated.

There are many artistic bracket and pole fixtures for the suspension of lamps which add to the beauty of the streets instead of detracting from their appearance in the day time. The tendency to use unsightly poles and fixtures is being rapidly overcome and wooden poles on city streets are becoming less and less used, and iron is coming into its own as by the use of iron almost any artistic, attractive shapes can be had. These fixtures, set off by properly designed globes or shades, are becoming an asset to the central station supplying them and to the town using them.

It is probable that the incandescent type of lamp will never displace the arc for lighting of city streets which have any business importance. The metallic flame arc produces a better light of greater volume with less energy consumption than any form of illuminant now produced by man. In installations on narrow streets or streets which are overhung with shade trees the series tungsten lamp will in many cases prove more satisfactory and cheaper to use than the arc lamp, less light being wasted by absorption by the foliage, owing to the fact that the lamps can be hung low down on the poles, and, while the installation cost in such cases would probably be higher than arc lamps and the maintenance cost, including the cost of current supply, be likewise greater, yet the efficiency under such conditions of service, considering the useful light given, would be better than an arc lamp which has extremely high intensity at its point of source, and therefore requires unobstructed, or practically unobstructed, space for the efficient distribution of the available light. In this respect the gas mantle lamp is capable of giving a service which, while not quite as satisfactory as the series tungsten, is still quite successful. Recent improvement in the treatment of the mantle has taken away the pronounced reddish-green tinge of the light which has been considerably criticised in the past.

Space is not available for a discussion

of the advance in the art of indoor lighting, which is a separate field, and requires considerable space to properly set forth what has been accomplished in the last several years, but it is sufficient to say that rapid progress will continue on account of the fact that the people as a whole are demanding better light each year. The merchants particularly are constantly on the lookout for any new form of light which will give them better results in the display of their goods, either by giving better color values, increased economy of operation or lower first cost, and I prophesy that inventors will rise to the demand and bring forth some improvements from year to year which will fill the requirements.

Such has been the history of the lighting business, that when the demand becomes insistent enough there has always been some one to come forward with brains and ability to produce a light to satisfy the demand.

Railroad Illuminating Engineering

IV.—Classification Yard Lighting.

By Harold Kirschberg.

One of the prime justifications for the services of an illuminating engineer on a railroad, at least from a railroad viewpoint, without consideration of the validity of such viewpoint, is his ability to save expenses. It is indeed to be regretted that a consideration of the saving accruing from a correct illumination layout usually applies to only the direct saving in either initial cost, energy consumption or maintenance cost. The ultimate results, which are productive of not only a saving of money and energy, but also an improvement of quality and quantity of work turned out with a betterment of conditions in general, are seldom given the attention that would be expected from such far-seeing corporations as railroads. The additional savings, whether of life or money, ensuing from safer conditions and the multitude of indirect beneficial results are quite often not even traced to their correct source. It may truly be said that on railroads in general good lighting is conspicuous by its absence. The importance of any piece of apparatus is usually accentuated by its accidental failure to work at which time the saving in expenses due to its successful operation assumes an unexpected prominence. The foregoing, applied to lighting on a railroad, is most particularly and forcibly true in the case of classification yard lighting.

A classification yard is used for the purpose of collecting freight cars into trains for particular routes and destinations. Reference to an analysis of track scale lighting by the writer in the May issue of The Illuminating Engineer will assist toward a clear understanding of the conditions imposed on the lighting of the location under consideration. After a collection freight train has covered its allotted division, taking all cars which have been loaded for shipment, it enters a receiving yard, where it is held until opportunity is afforded for it to pass over the scale, where each car is weighed and recorded. The operation of weighing is explained in the aforementioned article on track scale lighting.

After being weighed the cars float by gravity down the clearance grade and are distributed among the various tracks, according to route or destination, to make up other trains. The switching, done below the scale clearance grade, is controlled from a tower usually situated near the scale house. Various layouts of tracks, pick-up tracks, etc., are in use, a discussion of same not being necessary in this article. The trackage layout, however, must provide space for poles on which to mount lamps, and in as much as this layout is drawn up by the maintenance of way department, it is to be expected and also true that the space allotted to the lighting is not only often insufficient, but also poorly located. The usual lighting scheme employs a line of arcs down the center of the yard and a line on each side.

Other methods have also been used, with as poor results, but being improvements over still poorer original methods they have been voted successes. A discussion of some of these methods will follow later in this article. For a moment, however, and in line with a previous thought expressed herein, the writer desires to present the probable consequences of a failure of light in a classification yard with the object of showing that the initial cost to obtain a correct layout will be but a small part of the loss produced by a failure, and that such initial cost is justifiable no matter how high it may be in comparison with past practice.

As stated by the writer in former articles on the subject of railroad illuminating engineering, the major portion of a railroad's revenue depends on its freight haulage capacity. This capacity is as dependent upon scale and yard capacity as it is upon motive power equipment, and a congestion in either receiving or classification yards or a reduction in car movement over scales will reduce earning power as well as will a disablement of locomotives or a lack of cars. Naturally, loss of revenue from any of these causes carries with it a cumulative losing effect due to loss of prestige and good-will of the shipping public. Bearing in mind the fact that work of the nature explained herein continues both day and night, it must be evident that a disablement of a classification yard imposes a monetary loss of no small magnitude to a railroad.

Every car or draft of cars going down the yard is manned by a rider, who conducts his charge to the cars already on the track. Inability to see ahead would result in accidents to men, cars and shipments, and would preclude all possibility of classifying freight in a safe and economical manner. The lighting system employed is, therefore, an auxiliary of vital importance.

Many engineers in designing this class of lighting have considered a classification yard as an open space and have lighted it accordingly. An error of this sort will show, upon reflection, an incomplete consideration of the conditions to be met. Quite contrary to this idea, the problem of classification yard lighting may be stated to be more involved than any problem of street or park lighting. A classification yard consists of a series of streets 3 to 4 ft. wide, with buildings about 14 ft. high on both sides. The ideal system would, therefore, provide light on and between every pair of tracks. How close the ideal may be approached depends upon the allotted appropriation and the desires of the corporation and the designing engineer.

The conditions to be satisfied may be briefly stated as follows:

1. Illumination of the grade leading from the scale to the yard.

2. Illumination of the switches at the head of the yard, to facilitate control of car movement from the switch tower.

3. Illumination of every track, irrespective of positions of adjacent cars.

4. Illumination of every car in the yard.

5. Absence of glare from every position in the yard.

The foregoing must be accomplished without the retention of too much space from trackage, this space usually being allotted in advance, without regard to its adaptability for the purpose intended. The further considerations of type of illuminant and system to be employed will, therefore, be more or less dependent on other factors.

Many different methods have been employed, among which may be mentioned the following, with some of their advantages and disadvantages as viewed from an up-to-date standpoint, and in the light of the latest developments in lighting units.

Series A. C. Enclosed Carbon Arc.

ADVANTAGES.

Simplicity.
 Generation.
 Distribution.
Easy control.
All advantages of enclosed over open arc.

DISADVANTAGES.

Low efficiency.
Poor distrbution of light.
Necessity for reflector.

Series D. C. Enclosed Carbon Arc.

ADVANTAGES.

Same as series A. C. enclosed carbon arc, with better distribution of light.

DISADVANTAGES.

Low efficiency and high maintenance cost

when compared to latest series arc system.

Necessity for converting apparatus in an A. C. plant or for a Brush arc machine.

Flaming Arc.

ADVANTAGES.

High efficiency.

Low maintenance cost based on flux of light produced.

DISADVANTAGES.

Essentially a multiple proposition at the present time, necessitating a large transmission line and producing large C^2R loss.

Short trim.

With present lengths of trim obtainable, inability to use total length of carbon, unless trimming is to be done at any time, during day or night.

Too large a unit.

Projector Lamp.

ADVANTAGES.

Simple control.

DISADVANTAGES.

Light all thrown in one direction, thus producing objectionable glare.

Limited area illuminated at any one time.

Traveling of car in its own shadow.

Blinding effect on return trip, resulting in danger.

Lower efficiency of lamp compared to luminous and flaming arc lamps.

Illumination of yard dependent upon a single source of light.

Total interception of light by string of cars on tracks adjacent to running track.

Necessity for constant attendance.

Necessity for special electrical apparatus to secure direct current, low voltage supply if transmission line is alternating current.

Interference, due to glare, in adjoining yards or on main line tracks adjoining.

Necessity for additional auxiliary lamps throughout the yard.

Inability to distinguish signals in the glare, especially green signals.

Excessive cost of maintenance.

Short life of trim—three and one-half hours.

Luminous Arc Lamps.

ADVANTAGES.

All advantages of series systems in general.

Good distribution of light.

High efficiency.

Long trim.

Reliability.

Low maintenance cost based on flux of light produced.

DISADVANTAGES.

Necessity for converting apparatus in an A. C. plant or for a Brush arc machine.

Series Tungsten System.

ADVANTAGES.

All advantages of series systems.

Almost ideal distribution, if installed correctly.

Either direct or alternating current.

Fair efficiency.

DISADVANTAGES.

High initial cost of installation (posts or suspended wire).

High cost of maintenance compared to luminous or flaming arcs.

Necessity for reflectors to obtain desired distribution and overcome glare due to the low height of lamps.

In Europe flaming arcs are at present being used to a great extent for railroad yard lighting. Labor and material costs here, however, have held up similar action in this country for the present. The question of how large or how small a unit to use depends on how close an approach to the ideal of bright moonlight is desired. Other questions of maintenance are secondary, especially when the results of a failure are considered. The best that can be hoped for at present is the awakening and realization of the railroads to the value of good yard lighting. The best method will then he determined by intelligent effort and trial, if not by natural processes of improvement and elimination.

Legislation Regarding Illumination and Lighting Conditions at the Capitol

By Augustus D. Curtis.

The great ignorance of the layman as well as those in the lighting business is surprising. Probably greater ignorance exists in this important field than in any other modern science. While the problems of ventilating and heating have been fairly well solved and in the modern buildings of to-day this is accomplished in a fairly satisfactory way, the question of illumination is as yet treated as one of secondary moment and as hardly worth the attention of an expert.

The work you are doing in awakening consciousness to the necessity of carefully engineering the illumination of interiors is certainly work that should be appreciated.

As you state, vision depends upon more than simple intensity, which is the standard so generally used, and light is for the purpose of enabling us to see, and the extent to which it accomplishes this purpose measures its effectiveness.

The real test of illumination is the ability of the eye not only to discern these details distinctly, but to continue this visual effort for a great length of time without eye strain and fatigue.

Appreciating the great fatigue, eye strain and serious permanent injury to the eyes occasioned by exposed brilliant lighting units, it is frequently predicted that within a short time national legislation will be enacted absolutely prohibiting the use of injurious exposed brilliant lighting units in any large place.

Various illuminating engineers, oculists and others particularly interested in illumination, have expressed this view.

My experience covering something over two and one-half years with indirect illumination has convinced me that it is a question of but a short time before the majority of interior illumination will be accomplished by indirect or at least concealed methods.

Since the introduction of lamps of high intrinsic brilliancy complaints from all sections of the country are heard as to the increased ill effects resulting therefrom.

The lighting situation at Washington in the Capitol Buildings and department offices presents an interesting aspect. From there must come any legislation protecting the health and comfort of the people at large. Judging from the almost criminal illumination that has been and is still in use there, one would think that there was small prospect of serious consideration by our lawmakers of this important matter.

While the Senate and House Chambers are illuminated in a very satisfactory and rational manner; that is, semi-indirect illumination (skylight illumination in the daytime and artificial light thrown through the glass ceilings at night), the offices in the Capitol Building especially are illuminated in a most abominable manner. A great number of 32 candle power carbon filament lamps, usually within the range of vision, are placed either around the walls of the interiors or on fixtures of antique design, hanging below a center outlet. Expense or comfort does not seem to receive any consideration. The long tunnel-like corridors are illuminated with bare lamps at the ceiling, which furnish poor illumination and give a very gloomy appearance.

Recently, however, there seems to be an awakening in this respect, and Colonel Elliott Woods, superintendent of the Capitol Building and grounds, has at his own initiative had a number of installations made, which by contrast are awakening our lawmakers to recent developments in illumination and showing them that comfort and rational illumination are available.

As is patent to every one, it is almost impossible to use the tungsten lamps in all of their bare and glaring brilliancy. Either frosted globes or frosted bowls and decorative art glass must be used in connection with them to modify their intense brilliancy and make possible their use in direct lighting.

Indirect illumination in its recent developments, whereby the light is thrown by the proper appliances to the ceiling at the correct angle to reflect it back to the

working plane can be accomplished without more loss or waste than is used in protecting the eye by the frosted bowls and art work as mentioned.

A general impression seems to prevail that there is a great loss in efficiency by using this method of handling the light. This is an erroneous idea, as proven in hundreds of instances of practical application. The illustrations shown in another section of this issue are attracting much favorable comment.

Christian Jensen Toerring

MR. CHRISTIAN JENSEN TOERRING.

Mr. Christian Jensen Toerring died at his home in Philadelphia April 22nd, aged 39 years. He was born in Skive, Denmark, September 18, 1870. Upon the death of both of his parents in 1877 he was adopted by his uncle, Christian Toerring, of Davenport, Iowa. After completing the public school course in that city he entered the University of Illinois at Urbana, transferring to Cornell University in his junior year and graduating in 1893.

During his last year in college his study was directed toward the development of electric lighting, particularly the inclosed arc lamp, and he contributed liberally toward the inventions and improvements which eventually made this form of lamp a success.

His first position after leaving college was with the Royal Electric Company, afterward the Marks-Ayer Company, of New York City. He remained with this company for about a year and a half, when it was discontinued; and after spending a short time with the Washington Carbon Company he accepted a position with the Helios Electric Company of Philadelphia, where he assisted in developing an inclosed arc lamp. After spending two years with this company he organized the company which bears his name in 1898.

The arc lamps of his design are original and of distinctive merit. They were granted recognition at numerous expositions, including the award of the gold medal at the Paris Exposition in 1900; the Highest Award at the National Export Exposition, Philadelphia, 1899; Pan-American Exposition, Buffalo, 1901; and the Louisiana Purchase Exposition, St. Louis, 1904. The Edward Longstreth Medal of merit was awarded by the Franklin Institute in 1903.

Mr. Toerring had pre-eminently the scientific mind, and his experimental and research work was his greatest source of enjoyment. He was an enthusiastic worker, and considered his work in his chosen field only just begun. The subject of new illuminants appealed to him strongly, as did also the solution of practical lighting problems. He was a strong advocate of inverted lighting, *i. e.*, indirect illumination, and his inverted inclosed arc lamp, which he designed some years ago, gained many enthusiastic supporters and converts to this method of illumination.

Practical Problems in Illuminating Engineering

Indirect Illumination at the Capitol

By H. B. Wheeler.

This main office of the sergeant-at-arms' rooms at the Capitol (Fig. 1) is called the bank of the House, as here voucher distributions for salaries are made to the members of Congress, and there is a considerable force of employees.

This room, as shown by the sketch, Fig. 2, is 30 ft. wide by 33 ft. long, and has a slightly dome-shaped ceiling, the ceiling at the center being about a 17-ft. height and at the corners about 13 ft.

As is common with many rooms in the Capitol building, the ceiling not only is dome shaped, but has painted panels. The ceiling and walls are of light yellow in color, the panels being of brown.

FIG. 1.—OFFICE OF SERGEANT-AT-ARMS, CAPITOL, WASHINGTON, D. C., SHOWING EFFECT OF INDIRFCT ILLUMINATION.

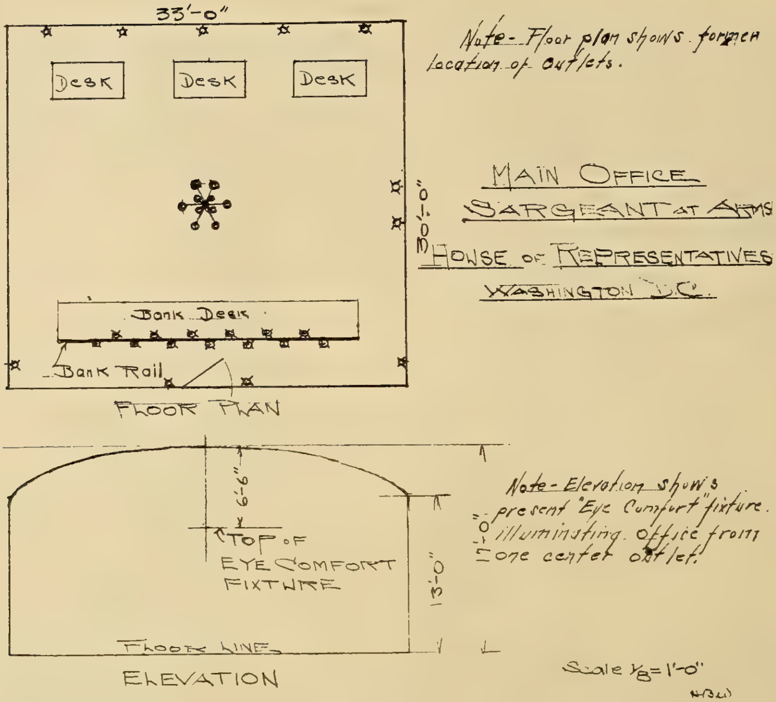


FIG. 2.

It is necessary to use artificial light at all times in this room. The arrangements for lighting in this room have been changed a number of times, but have never been satisfactory. The last installation consisted of 30 32-cp. carbon filament lamps and 4 16-cp. carbon filament lamps, a total watt consumption of 3574. The lamps were arranged around the walls of the room, along the front of the bank counter, about 7 ft. from the floor, and in a chandelier hanging from the center of the room. A most unsatisfactory and trying installation.

Indirect illumination has proved a revelation in this office, and has met with enthusiastic approval by those who have been tortured by the previous almost criminal lighting arrangement.

It consists of a fixture containing 15 indirect lighting units, each containing a 100-watt clear bulb tungsten lamp in the distributing type of reflector, top of same 6½ ft. from the ceiling. The basis for wattage was arrived at for this installation as follows:

Using 1500 watts for an area of 990 sq. ft., should give a wattage of 1.52 watts per square foot. For a room of this size one would figure .37 watts per lumen if the ceiling is light, but as this ceiling is broken by the painted paneled beams, and not very light in color, 30 per cent. was added to .37, making .48 watts per lumen. Dividing 1.52 watts per square foot by .48 watts per lumen would give approximately 3.02 foot-candles. This is figured on the basis of fairly dark walls and mahogany furnishings. Were the walls and ceiling to be lighted up, the illumination would undoubtedly be from 3.50 to 4 foot-candles at the plane of the desks.

In this main office it will be noted the current consumption is 1500 watts, in comparison with 3574 watts previously used. The saving, however, is nothing compared with the great eye comfort by those now using the room.

Colonel Henry Casson, sergeant-at-arms, states:

"It is the best light I think I have ever seen of any description, and I cannot speak too highly of the soft, pleasing ef-

fect. It has been pronounced by every one who has seen it as perfect in every way. The most remote corners of the room are as light as the center, where the fixtures are. I do not know how these lights could be improved on. Certainly they are a great comfort to the office force, who are obliged to work by electric light by day and often at night."

Colonel Casson's private office is also illuminated by the indirect system. Size 30 x 18 ft. and ceiling the same as main office. At the central outlet is installed one fixture containing nine 100-watt, clear bulb tungsten lamps, also in the distributing type of reflectors, top of same 4 ft. from the ceiling. The illumination in this private office is equally satisfactory.

The illustration Fig. 3 shows the entrance way to the house side of the Capitol Building. It has been necessary to illuminate this space at all times, as there are no outside windows sufficient to furnish light. Never since the Capitol has been built has this entrance been satisfactorily lighted until now.

In common with most of the passage ways and rooms in the old Capitol Building, it has an arched ceiling. As will be noted, the entrance is approached through swinging doors, which brings one immediately into this corridor, which is flanked on either side by elevators and large marble arches, which support the heavy structure above. Back of these arches are dark recesses, which are practically waste

FIG. 3.—ENTRANCE WAY TO CAPITOL, HOUSE SIDE, SHOWING EFFECT OF NEW INDIRECT ILLUMINATION.

spaces. As stated by Mr. Gliem, mechanical and electrical engineer of the Capitol Buildings, the lighting of this entrance was one of the most difficult problems they had.

At certain time of the day, this entrance way is crowded with members of Congress and visitors passing in and out and using the elevators, and direct lighting, as formerly used in the top center of the dome, furnished very poor illumination, and it was almost impossible to recognize one. Besides this, coming from the daylight into this dimly lighted corridor presented a very gloomy appearance, which was enhanced by the massive architecture and deep recesses mentioned.

As the dome was of a light brown color, with recess panels surrounded by gold moldings, there was a question as to the desirability of attempting the illumination by indirect methods. The fixture as shown, however, containing four indirect lighting units, each covering a 100-watt clear bulb tungsten lamp, solved this problem in a most satisfactory way.

The appearance of this corridor is now as if there was skylight daylight illumination from the dome, and the result is such that much favorable comment is expressed, especially by those who previously experienced the poor lighting of this space.

Inverted Incandescent Gas Lamps in Men's Furnishing Stores

By Norman Macbeth.

Fig. 1 is the interior of the Men's Wear Company's store, Main street, Buffalo. This store is very satisfactorily lighted with standard fixtures developed for use

FIG. 1.—MEN'S WEAR COMPANY'S STORE, BUFFALO, N. Y., ILLUMINATED BY INVERTED INCANDESCENT GAS LAMPS AND PRISMATIC REFLECTORS.

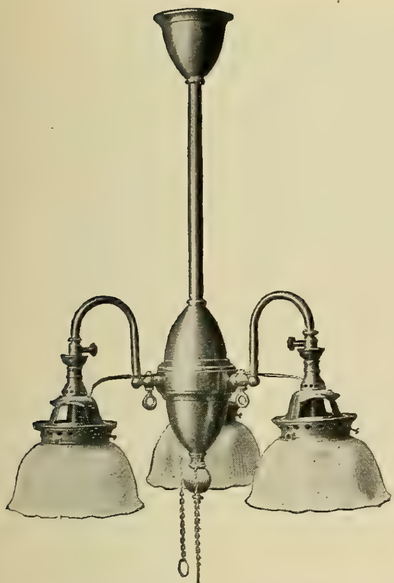


FIG. 2.—TYPE OF UNIT USED.

with inverted gas lamps, Fig. 2 using natural gas. The fixtures are hung at a height of 11 ft. on outlets at 14-ft. distances, the distance between the two rows of outlets being 10 ft.

The store dimensions are 26 ft. 6 in. by 62 ft. The windows extend along the front of the store and are illuminated with similar inverted gas lamps through a glass deck.

The intensity of the illumination throughout the store is between 7 and 8 foot-candles.

The height of the ceiling is 16 ft.

Height of mantles, 11 ft.

Number of fixtures, 8.

Number of lamps, 32.

Average consumption of lamps, cu. ft., 2.66.

Total consumption of lamps in cu. ft., 85.

Total area of floor, sq. ft., 1439.

Sq. ft. per cu. ft. of gas, 17.

Cu. ft. of gas per sq. ft., .059.

Ceiling, light colored paper.

Walls, light green colored paper.

The average consumption of burners and mantles of the size and type here used with natural gas is about 20 per cent. less than that for similar lamps when used on artificial gas, with a somewhat higher light output per unit. The lumens per cubic foot of natural gas, at the usual 4-oz. pressure, is therefore 50 per cent. higher than the lumens per cubic foot of artificial gas at 2 to 3 in. of water pressure for similar equipment.

As a result of the satisfactory experience with the Buffalo installation, the store

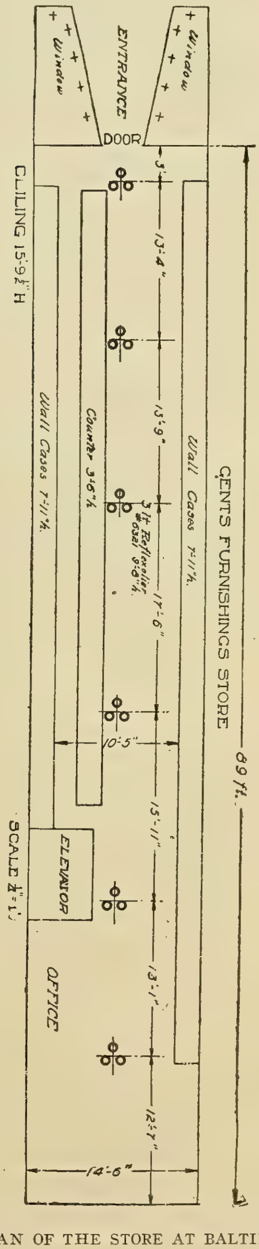


FIG. 3.—PLAN OF THE STORE AT BALTIMORE, MD.

FIG. 4.—STORE AT SYRACUSE, N. Y., SHOWING EFFECT OF NEW ILLUMINATION.

shown in the photograph, Fig. 4, was taken up. This is the Men's Wear Company's store in Syracuse, N. Y.

This store was formerly lighted with seven cluster fixtures, with flat opal reflectors, using six 60-watt tungsten lamps in each.

The dimensions considered, 122 ft. deep by 17 ft. wide between the walls, 14 ft. between shelving, result in an effective area of 1708 sq. ft.

The three outlets in front of the store were placed 12 ft. apart, while the rear outlets, where as high an intensity of illumination was not desired, were spaced 17 ft. apart. The fixtures used, Fig. 2, were of the standard length of 2 ft., which brought the mantles approximately 11 ft. above the floor. Considering the effective area of the store, deducting for shelving, as approximately 1700 sq. ft., which with the nominal rating for these lamps with artificial gas, 3.3 cu. ft. per lamp, with 28 lamps, results in an average consumption of 0.054 cu. ft. per sq. ft. per hour.

The closer spacing of outlets in the front of the store gives an average of 0.08 cu. ft. of gas per sq. ft., while that in the rear is 0.05. This would provide for 8 foot-candles average intensity in the front and 5 foot-candles in the rear. The factor for the lamps and reflectors here used, with light ceiling and dark walls, for that effective illumination on a horizontal plane of 1 foot-candle per sq. ft. is 0.01 cu. ft. of gas per hour, or 100 lumens per cu. ft.

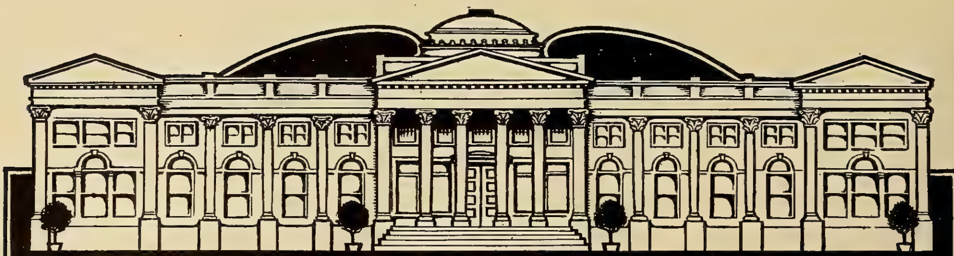
The tungsten wattage on this floor was 2520 watts per hour, or 1.48 watts per sq. ft.

Fig. 5 shows the interior of a men's furnishing store in Baltimore, of which Fig. 3 is the plan. This store is 89 ft. deep by 14 ft. 6 in. wide, with a ceiling 15 ft. 9½ in. high. The decorations would generally be classed as light. Wall cases 7 ft. 11 in. high by 2 ft. deep reduce the effective area to approximately 1006 sq. ft.

There are here installed six three-light fixtures similar to Fig. 2, with inverted gas lamps, with prismatic reflectors at a height of 9 ft. 8 in. from the floor to the center of the mantles, and outlets approximately 15 ft. apart.

The total consumption is 60 cu. ft. of gas per hour, or .06 cu. ft. of gas per effective sq. ft. of plane to be illuminated. This does not include the wall cases. This equipment under these conditions would give an intensity of approximately 6 ft. candles, which results in a somewhat brilliant illumination effect.

FIG. 5.—STORE AT BALTIMORE, MD.



Studies of Notable Installations

The Blackstone Hotel, Chicago

If any justification were needed for considering the lighting of this structure a notable installation it might be found in the fact that the architects, Messrs. Marshall & Fox, have received a gold medal from the Architects' Society for having produced the most perfect hotel in its convenience for guests, artistic design and modern equipment in the world. The World's Fair of 1893 showed what Chicago could do in the way of magnificence and artistic effect in architecture; and when the city suddenly awoke to the necessity of increasing its hotel accommodations it was to be expected that no half-way measures would be taken.

FIG. I.—GRECIAN MARBLE CAFÉ, SHOWING TYPE OF INDIRECT LIGHTING UNIT.

FIG. 2.—CORNER OF GRILL ROOM, SHOWING ARRANGEMENT OF INDIRECT LIGHTING UNITS.

The Blackstone Hotel, though but one of several of the new buildings for this purpose, shows that Chicago is equal to her record. In order that the hotel should represent the very latest achievements in comfort and convenience for its guests, Mr. Drake, the president of the Blackstone Hotel Company, visited all of the large hotels of the East to study not only their good qualities, but their deficiencies, if such existed, as well. He found that there was at least one common deficiency, viz., the artificial lighting, and resolved that the guests of the Blackstone should have no just cause for complaint on this score. He took the matter up with his architects, in connection with illuminating engineers, and endeavored in this, as in all the other facilities, to reach as near perfection as the present state of the science and art of illumination would permit.

In a general way the installation may be divided into two parts; that in which direct lighting is used, and that in which indirect illumination is installed. The choice between these two methods was determined primarily by utility, and, secondarily, by artistic considerations. As much of the interior architecture is of the Louis XVI. period, the fixtures naturally were adapted from this school of design; but where variations in the architecture permitted, or where utility was of prime importance, indirect lighting has been used. It is this latter part of the installation which we will examine at the present time. It may be stated in this connection that this is the first hotel to adopt this method of illumination on an extensive scale.

Fig. 1 is a view in the exquisite Grecian Marble Café. The ceiling here is divided into comparatively small and very deep panels, and is finished in ivory white. The fixtures consist of shallow bowls sus-

pended by bronze chains. Each bowl contains 20 indirect lighting units, consisting of 60-watt tungsten lamps, with clear bulbs and reflectors. The room is 47 x 50 ft., with a 16-ft. ceiling. The bowls are hung 4 ft. from the ceiling, there being six of them in the room. It is generally conceded by architects that pure classical architecture furnishes one of the most difficult of all problems to handle with respect to artificial lighting. The methods used in ancient Greece were so absolutely inadequate and unadaptable to modern conditions as to render them out of the question as models. The only alternative is, therefore, an adaptation of twentieth century lighting units to an architecture 20 centuries old. The indirect method of illumination possesses the unquestioned advantage of removing the actual sources from view, so that there is no possibility of a direct suggestion of incongruity, while the general diffusion of the light after the manner of daylight brings out the architectural features in their proper perspective and relations.

Another strictly classical and equally magnificent room is that utilized as a barber shop, and shown on the front cover of this issue. This is claimed, and apparently with perfect justice, to be the most beautifully furnished and equipped barber shop in the world. The ceiling, as shown, has a large cove decorated with a latticed design. The central portion is finished in a delicate blue tint, while on the latticed portion pale blue and white are used. The lighting fixtures follow strictly the classical lines. Each contains five indirect lighting units, consisting of 100-watt, clear tungsten lamps, with reflectors. The removal of all light-sources from the field of vision is certainly a most desirable thing in the case of a barber shop, for there is nothing more annoying to a patron than to be obliged to stare into a dazzling lamp or reflector hung above his face, or in such position that

FIG. 3.—VIEW OF KITCHEN, SHOWING TWO-LIGHT INDIRECT UNITS.

there is absolutely no escape from its glare.

Fig. 2 is a corner of the grill room, showing the elaborate arrangement of ranges and serving counters. The indirect lighting here is of a decidedly novel and interesting character. The ceiling is broken up into a large number of shallow polygonal panels, at the chief intersecting points of which are suspended single tungsten lamps and special indirect lighting units. From the engineering viewpoint this room is remarkable as showing the possibility of using the indirect lighting system with a highly decorated ceiling and units placed in very close proximity to it. Side brackets, with imitation candles, are used for purely decorative effect.

Fig. 3 is a view of the kitchen. There used to be a saying among traveling men that "if you want to enjoy your meals at a hotel keep out of the kitchen." The view of the kitchen here shown certainly gives the lie to this proverb. It is impossible to conceive of anything more scrupulously clean and inviting than this modern culinary laboratory. The indirect lighting fixtures used here are of a commercial type, each consisting of two units supplied with 100-watt tungsten lamps. The tops of the reflectors are 18 in. from the ceiling, which is of white tile. The chef, Carl Decker, perhaps describes the result as briefly and completely as it could be put: "We have daylight here 24 hours a day."

Besides the rooms illustrated, the buffet and the business offices are also equipped with indirect lighting systems. The former offered rather unusual obstacles to this method in that the ceiling was divided into a number of deeply recessed panels, which are finished in light gray, while the woodwork and furnishings are of dark color. The room is 68 x 44 ft., with a 10 ft. 8 in. ceiling. There are 109 panels, in the center of each of which is placed an indirect lighting unit containing a 60-watt clear tungsten lamp. The resulting illumination is entirely satisfactory.

The indirect method was chosen for the offices, with the belief that it furnished an illumination less trying to the eyes, and, therefore, more efficient in point of output of those using it than direct methods; and the results seem to fully bear out this assumption.

The modern high-class hotel offers in its entirety one of the most attractive problems for the illuminating engineer that can be found in the whole field of lighting. From the purely utilitarian necessities of the kitchen, store rooms and hallways to the rooms in which a correctly artistic effect, together with adequate illumination is absolutely essential, there is almost every gradation between the useful and the beautiful.

In addition to this the question of cost of maintenance and operation must be constantly kept in view, as the lighting bills of a large hotel are no small item. The introduction of special scenic and pictorial effects for roof-gardens and cafés is another one of the problems offering unusual opportunities for originality of conception and artistic taste. Fortunately, the engineer's abilities are less apt to be handicapped by money restrictions than in buildings that are more purely commercial.

Some hotels have made a reputation on their cooking, others upon the excellence of the service and still others upon their location and surroundings. It is by no means impossible for a hotel in these days to establish a reputation and patronage on account of the excellence and beauty of its artificial lighting.

Fixtures and Accessories

The Movement Toward the Organization of the Fixture Trade

The Illuminating Engineer at various times in the past has taken occasion to point out the anomalous condition of the fixture trade in this country in being entirely without organization, as well as the benefits which must inevitably accrue from such organization. More recently we have had occasion to welcome a new contemporary, *Illumination,* which has taken up the campaign in earnest, and has worked assiduously to bring about an organization of the fixture interests. In this work we tender our fullest sympathies and good wishes.

While we are on the subject, however, we venture to suggest that the editor of our contemporary is making one serious mistake, and that is in permitting his own name to be brought forward for the position of secretary for the proposed association. If the trade or technical press has any mission in this world aside from meeting its printers' bills it is to act as an unbiased, unprejudiced and friendly, but independent, critic of all conditions affecting the particular branch of industry which it represents. Criticism is of value only when it is given absolutely without ulterior motive or pressure from without. The actual executive work in such organizations generally devolves largely upon the secretary, and it is manifestly a difficult problem for the editor of a trade journal to criticise the secretary of the association when the two are the same person. Furthermore, there should be not even grounds for suspicion of an association being used to further the commercial interests of a publication. Aside from this discrepancy the work which our contemporary is doing is in every way deserving of the co-operation and good-will of the fixture trade.

It is curious, and oftentimes amusing, to hear the objections that are raised to the organization of the fixture interests by their own members. The objections all simmer down to the final proposition: That the fixture business cannot be gauged by the commercial laws and rules which hold in all other industries. It is impossible for the outsider to discover any sufficient proof of this proposition. While every line of industry has its own peculiarities to a certain extent, there is no possible reason for assuming that fixture manufacturers and dealers have been singled out by Providence to bear insuperable burdens. The fixture business, like many other lines of business, is simply a particular branch of artisanship, *i. e.,* of manufacture in which the application of art plays a more or less important part. A dozen other lines having this characteristic will suggest themselves to any one offhand; wall paper, jewelry, most textiles and furniture are some of those that first suggest themselves.

Perhaps the nearest analogy to the present conditions in the fixture business is that of the glass tableware makers some years ago. There was then the same universal suspicion among the different manufacturers, and the same bitter complaints of stealing one another's designs. There is perhaps no division of artisanship in which design is of such commercial importance as in this kind of glassware. The manufacturer who had the good fortune to strike the popular fancy was assured of a good year's business, and likewise of being speedily imitated by his competitors.

After several attempts an effective organization was formed, which immediately began to improve conditions, and in the end resulted in as satisfactory a condition of the industry as can be expected in human affairs.

The arguments as to the impossibility of an organization exerting any control over the present lamentable conditions in the fixture industry would have been equally applicable to the glass industry. It is said that there is no possibility of controlling the raw materials, nor of limiting the number of makers, either of parts or complete fixtures, or of preventing copies of the designs of the different makers. With the possible exception of the petroleum industry, these arguments apply to every branch of the industrial world; and yet there are few branches in this country that have not organizations that are highly beneficial. As a matter of fact it is absolutely impossible to protect originality in any direction, nor is it perhaps desirable. From the successful book to the successful mouse-trap, a trail of imitators may always be found, and, what is more, always will be found. Brass jewelry set with glass is always more abundant than gold and jewels, for the two reasons that it is easier to make, and can be sold at a far cheaper price. The value of the real article, however, remains uninfluenced by the output of the imitation.

From an outside point of view it looks as if this hue and cry about imitation were badly overdrawn; and if the truth were known it would probably be found that those complaining are much more badly scared than hurt. Judging by all precedents, a fairly representative organization of fixture manufacturers and dealers could reduce this evil to a harmless minimum.

Other palpable evils, such as expensive duplication of designs, unfair tenders for bids and improper use of sketches and information supplied in bidding for business could also undoubtedly be very greatly alleviated, if not practically abolished.

But the removal of unsatisfactory trade conditions, desirable as it is, is by no means the sole object to be gained in organization. The general uplift in *morale* of the business and of those engaged in it would be of perhaps even greater ultimate value. That there is room for such uplift seems to be universally conceded by those most interested. We are by no means persuaded that the fixture trade, individually and collectively, has committed the unpardonable sin, and is depraved beyond all hope of regeneration. We believe that getting together and talking matters over face to face as fully and frankly as possible will have the same general beneficent effect in this case as in the scores of others in which it has taken place. By all means let it at least receive a thorough trial.

Men are seldom as bad as they talk, and there is no remedy for mutual mistrust and recrimination so effective as a face-to-face and heart-to-heart talking out of the whole subject. If common hearsay may be credited with at least partial truth, the conditions in the fixture trade have been going from bad to worse for a number of years past. Manifestly, such a condition cannot indefinitely continue without actual disaster. It is the part of wisdom for those interested to take matters in hand at the earliest possible moment. Nothing can be gained by delay. If, as some of the more pessimistic would have us believe, nothing can be gained by action of the kind proposed, then the sooner it is known the better, in order that other measures of relief may be sought.

Theory and Technology

Ascertaining Mean Candle Power and Flux From Photometric Curves

By J. S. Codman.

In practical work, when flux values are to be ascertained from the polar diagram with rapidity, neither the Rousseau nor Kennelly diagrams are satisfactory. Macbeth's method [1] of reading the candle power at certain angles, determined by consideration of the Rousseau diagram, and finding from the arithmetical mean of the values so obtained, the mean spherical or hemispherical candle power is very rapid and convenient, but it does not enable the mean zonular candle powers or zonular flux values to be obtained, and, further, unless the curves platted on a Macbeth flux polar diagram, it is necessary to memorize the special angles at which to read the candle power to keep a table of them on hand or to make use of a specially marked protractor.

Again Wohlauer's " Fluxolite " paper [2] is not of assistance when the curve to be studied does not happen to be platted on it. Much the greater number of curves which an engineer has to study are not platted either on flux polar diagrams or on " Fluxolite " paper, and it is at least doubtful whether it would be best if they were, considering that additional lines tend to obscure the sheet and make reading difficult.

It seems to the writer that the best method of ascertaining flux values in a minimum of time, especially when all of the zonal values are desired in addition to those for the sphere and hemisphere, is a modification of a method described by Rolph and the writer himself,[3] and based on Wohlauer's formulæ. Wohlauer has shown [2] that the flux through any zone is

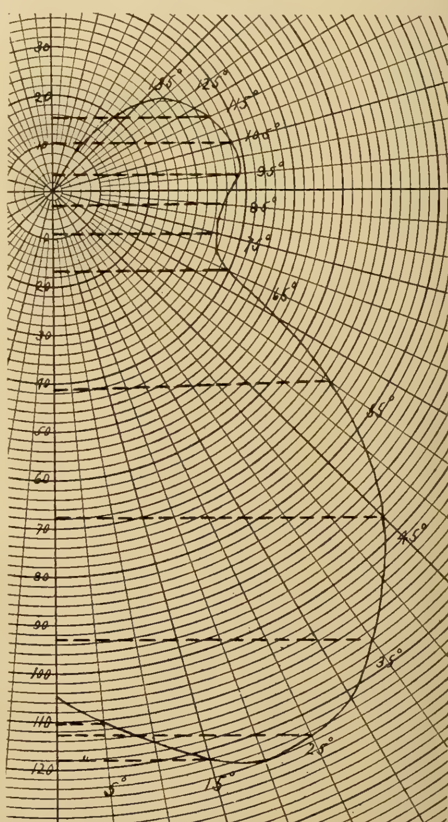


FIG. I.

[1] Illuminating Engineer, Vol. III., No. 1.
[2] Illuminating Engineer, Vol. III., No. 12.
[3] Illuminating Engineer, Vol. IV., No. 3.

directly proportional to the distance from the vertical to the mid-zone point of the photometric curve. Some of these distances for 10-degree zones are indicated by heavy dotted lines in the accompanying diagram. Rolph and the writer have shown that these distances can be measured directly in lumens by means of a properly prepared scale, but if no such scale has been prepared or is not at hand, the procedure is as follows:

Take a piece of paper or card with a straight edge and use the edge for a scale, marking the zero of the scale at any convenient point. Place the zero of the scale on the vertical line of the diagram, and lay off on the scale the distance to the first mid-zone point. Place the point of the scale so found on the vertical line and lay off on the side the distance to the next mid-zone point. If this process is continued up to 90 degrees or 180 degrees the length of the scale will be proportional to the flux through the hemisphere or sphere, and the divisions of the scale will be proportional to the flux through the zones.

To ascertain the flux values from this scale it is necessary to determine the length of each division in terms of candle power, which, of course, is easily done by placing the scale with the zero at the center of the diagram, and these values can be translated into lumens by multiplying by a constant, which constant depends on the size of the zones. With 10-degree zones, this constant is 1.095, or very nearly 1.1, which shows that the lumens can be found from the candle power values by adding 10 per cent.

The above described method is very quick, gives all the zonular values of flux if desired, requires no special polar paper, no protractor nor any list of angles, and requires the remembrance of but one factor, the multiplying constant 1.095, or, for rough work, the addition of 10 per cent.

A very similar method to this the writer has previously described,* but the idea of adding together the lines representing flux rather than the flux values themselves belongs to Mr. Ward Harrison, of Cleveland. In such case it is, of course, only necessary to measure that portion of the scale which is proportional to the flux desired.

In offices where it is a regular part of the routine to calculate and *record* flux values for different light sources, the writer strongly favors the use of multiplying constants. It has been demonstrated by a number of writers that the flux in lumens through a zone can be obtained with sufficient accuracy, provided zone is not too large, or photometric curve too irregular, by multiplying the mid-zone intensity by a constant dependent on size and position of zone.

The constants can be found from expression $2\pi\ (\cos\theta_1 - \cos\theta_2)$ by substituting for ϕ_1 and ϕ_2 the values of the angles with the vertical which determine the zones.

The most practical manner of using these constants is to have a number of sheets printed with a table giving the constants in a vertical column, with another column for filling in the mid-zone values of the candle power, and a third for the products of candle power and constants; that is, the flux in lumens.

In addition, on this sheet should be given a column for zones 0°-10°, 0°-20°, 0°-30°, etc., and a column for lumens in these zones, the latter values being obtained by addition from the fourth column. The idea of such a sheet for 10-degree zones is shown.

Zone. Degrees.	Lumen constant.	Zone. Degrees.
0- 10	.0954	0- 10
10- 20	.283	0- 20
20- 30	.463	0- 30
30- 40	.628	0- 40
40- 50	.774	0- 50
50- 60	.897	0- 60
60- 70	.992	0- 70
70- 80	1.058	0- 80
80- 90	1.091	0- 90
90-100	1.091	0-100
100-110	1.058	0-110
110-120	.992	0-120
120-130	.897	0-130
130-140	.774	0-140
140-150	.628	0-150
150-160	.463	0-160
160-170	.283	0-170
170-180	.0954	0-180

With these sheets the candle power values can be recorded when obtained.

It should be noted that if the test readings of candle power are made at 5, 15, 25 degrees, etc., the mid-zone candle powers are obtained at once, without the intermediate step of a photometric curve, and thus both additional speed and accuracy are obtained.

* Illuminating Engineer, London, Vol. III., No. 2, Feb., 1910.

A Visitor's Impression of the N. E. L. A. Convention

"* * * *Though by your smiling you seem to say so.*"

The smile of the man who infers that the convention is a joke or a junket belongs to the past.

The convention was no joke.

Doubtless of all the gatherings of the central station men of this country the recent convention of the National Electric Light Association was the most businesslike—for, after all, business is business.

Quite apart from the fact that the attendance at this recent convention surpassed by many hundreds the record of any preceding, it was apparent to every one who attended that the central station industry has outgrown the lazybones and the dilletante; nor can the real significance of this event be sensed by any one feature. The program does not tell the story. Even by searching through the papers and the discussion, word for word, one cannot realize the far-reaching effects of the coming together of so many men who are bound up in this particular business of running a central station.

A ship on a heavy sea is child's play compared with the job laid out for even the best of the men who are engaged in steering a central station. The ship on the high seas goes through the storm, and fair weather returns; but, for the central station man, of fair sailing there is none—no haven. The channel is ever changing with a Scylla and Charybdis to bob up over the horizon every day, and a compass which jumps and veers to the latest development in the industry.

It reminds one of the purgatory laid out for the billiard player:

"*With twisted cue and cloth untrue*
And elliptical billiard balls."

This last convention at St. Louis was work. Nor need it be imagined that all the work was done from the rostrum. There was work for the exhibitors and exhibitees. Everywhere one could find two or more central station men gathered together enveloped in an atmosphere surcharged with central station management; going and coming you might hear something like this from some representative who had had a particularly difficult prospect to win and was eager to have his fellows know about it:

"Let me tell you about a gink we had in our town. * * *"

And he would forthwith proceed to explain to those about him how he had made his prospect see things in the right way; for consumers are consumers, and are not always given to appreciating what can be done for them by the purveyor of electricity.

With so many papers and discussions there was a good deal of indigestion. There was undoubtedly cause for dissatisfaction that there could not have been more time to go more thoroughly into various problems which are coming forward insistently every year. There seemed to exist a feeling in the minds of many that a week, long as it looks on the calendar, is an insufficient period in which to get the best results from the opportunities presented by the "coming together of the clans."

At any rate, it is true that not only are the larger companies sending more men, but that the representatives of the smaller

companies are becoming really more interested in their work. From the fact of their becoming interested there lies before the industry a future which no man cares to take the measure of. It means harder work, more specialization (as was emphatically pointed out by one of the most progressive men of the industry), and consequently a division of effort by which each should become more efficient in his particular work.

H. RIDDELL.

A Long Distance View of the Convention

There are some cases in which the perspective of time or distance renders a view of events more faithful to the facts than one obtained at closer range. The photograph that covers a large field at short range invariably foreshortens and distorts. The impression of the convention made upon one who was not in attendance, and who must, therefore, depend upon reports, verbal and otherwise, for his opinion is not without its advantages.

The most obvious fact in regard to the gathering was its size. The industry represented is among the greatest in the country. The association is practically co-extensive with the commercial use of electricity, and has the accumulated strength and proportions of age and experience. It has always been vigorous and progressive, and especially within the past year has its growth been fostered with unusual diligence and success. Its financial resources are abundant. Special efforts were made to make the convention surpass in magnitude all of its predecessors. Under these circumstances it was to be expected that the event would be consummated on a magnificent scale, and in this there was no ground for disappointment. The attendance even surpassed the most sanguine expectations. The programme of papers was long, and apparently covered the entire scope of the subject, technical, commercial and historical.

While there is a certain power and inspiration in the mere aggregation of individuals this is by no means the only, or perhaps even the larger element in judging the real success of the convention. The element of quality applies to this case quite as much as to more tangible products. Mere perfunctory attendance by those whose expenses are charged up to a corporation, or by others who make it the occasion of a junket or pleasure trip, would count for little in the total of permanent good. For an event of such size and importance this source of weakness is surprisingly small. While there is a very justifiable and laudable tendency to get genuine recreation out of the meeting, there is no question as to the general spirit of seriousness and earnest effort to get the very most on the part of those in attendance.

As mere numbers in attendance do not indicate the strength of the gathering, so the programme of papers and addresses is not to be judged in value of its length. There are few things easier on such occasions than to secure what purports to be a paper, and few things more difficult than to secure a collection of papers which contain matter of originality and genuine worth. The generality of convention papers could be boiled down, and skimmed in the process of boiling, without in the least reducing their food value. While the papers in the present instance are not entirely immune from this criticism, they are far from being either weak or stale. They represent a good general average.

The most imminent danger which the association now faces is that of making its conventions unwieldy. The enormous growth, not only in financial importance, but in details of operation, of the electrical industry since the association was formed must, of course, be represented in the conduct of its affairs. The question is, therefore, not what to leave out of consideration, but rather what to add and how to present it so that every one shall be able to obtain the full benefit therefrom. Double or triple sessions running simultaneously are a questionable solution of the problem. The small central station is vastly in the majority in numbers, and the commercial and technical are, therefore, very frequently combined in the same individual. Not having the felicity to have been born twins or triplets, he cannot well be in attendance at two or three different sessions at the same time.

There seem to be only two possible

solutions of this difficulty—either to continue the convention for a longer period of time, or to go back to the original plan of holding it semi-annually. In view of the fact that the association started, and evidently thrived in its earlier years, on the biennial convention plan, there would appear to be no serious objection to a return to this plan. It might be feasible to divide along the general lines between the commercial and the technical in these two meetings, combining the exhibition feature with the commercial meeting only.

Whatever method may be adopted to meet the condition, there can be no doubt as to the fact that the limit of size as to papers and programme for a single convention has been reached. The present session consumed a business week, and it is hardly worth while considering extending it beyond this time limit. While there are few who would care to be absent from their posts more than one week at a time there are many who would not object to such an absence at two different intervals in the year.

The Johns Hopkins University Course of Lectures on Illuminating Engineering

As noted elsewhere in this issue, a course of 36 lectures on illuminating engineering is to be delivered at the Johns Hopkins University, Baltimore, between October 26 to November 8, 1910. This course is to be given as a result of cooperation between the university and the Illuminating Engineering Society, immediately following the society's convention, which will also be held at the university.

The announcement of this event affords ample material for comment and suggestion. Perhaps the first thought which will occur is that it puts the last touch to the seal of approval and recognition of illuminating engineering as a distinct branch of science and art. The Johns Hopkins University probably comes nearer to realizing the meaning of the term "university" in its original European sense than any other institution in America. The woods used to be full of "colleges," many of which were rich in promise, but poor of facilities and students. When it became known that a "university" was of higher grade than a "college" a considerable number of these young hopefuls took Hamlet's advice "to assume a virtue if you possess it not," and straightway became "universities." The Baltimore institution, however, was never of this class; it started out as a genuine university, or post-graduate college, and has always maintained a standard of scholarship, both among its students and professors, in keeping with the best traditions of its title. That the oldest real university in this country should be the first seat of learning of this rank to officially recognize illuminating engineering should be particularly pleasing to the pioneers who have labored faithfully in the cause for the past decade.

The next most natural suggestion is the high standing of the lecturers chosen. Three of the lecturers are professors in the university, and among the others are representatives of the National Bureau of Standards, Columbia University, Stevens Institute of Technology, the architectural profession and the scientific departments of some of the largest gas and electric interests of this country and England. It would be difficult to select a more conspicuous representation of the various phases of the science, art and commerce of illumination than is included in this list of lecturers.

One of the stated objects of the course is "to indicate the proper co-ordination of those arts and sciences which constitute illuminating engineering," and "to furnish a condensed outline of study suitable for elaboration for introduction into the curricula of under-graduate technical schools."

While the entire course is to be comprehended in 36 lectures, an inspection of the subjects will at once show how briefly these lectures must treat these particular subjects, and how necessary it would be to extend each into an entire course of lectures or instruction in order to give anything like adequate knowledge to the student taking up the course as a beginner. Add to these special subjects the necessary foundation knowledge of mathematics, chemistry, physics, physiology, psy-

chology, electricity, mechanical and free-hand drawing, English composition, and at least a reading knowledge of French and German, and it will be seen how readily three or four years might be expended in a college course leading to the degree of Illuminating Engineer.

But even a four years' course laid out on this basis, and diligently pursued, would furnish only the foundation for real illuminating engineering. Practice, experience and a certain natural aptitude would have to be added to these academic acquirements. If such a course of study, supplemented by practical training and experience, is necessary to constitute an illuminating engineer, it is somewhat curious to reflect upon the actual number of qualified illuminating engineers in the profession to-day, and the true measure of value of the services of those who have assumed the title by inspiration.

The presentation of this special course of lectures is an important event in the history of illuminating engineering. The next most important event will be the results arising from the actual delivery of the lectures as measured by the attendance at the course. The first is an accomplished fact; the second remains yet to be seen. We have faith to believe that the consummation will not fall short of the high conception of the scheme.

"Lights Far Out at Sea"

If certain enterprising electric sign men have their way the title of the sweet old sentimental ballad will take on a meaning expressive of the rank commercialism of the present age. Having possessed the earth, and even invaded the sky, the electric sign now seeks to make the ocean, or at least that portion of it bordering the popular summer resorts, resplendent with its glowing legends and bewildering effects of light. It has been proposed to erect large electric signs on barges, with the necessary equipment for generating current, and to either anchor these off shore or propel them slowly back and forth in front of the world-famous boardwalk at Atlantic City.

At first thought it would seem that this could only be an additional contribution to the gaiety of nations for which this resort is famous. The local authorities, however, seem to take a different view of the matter, and have strenuously protested to the War Department against what they consider an encroachment upon their preserves.

The problem is certainly a novel one. The electric sign has presented quite as unique a problem to the government as did the accession of the Philippine Islands. From the technical point of view it is difficult to see what the War Department can do in the matter, except to treat it strictly as to its effect upon navigation. The right of the government to police all waters within three miles from shore is unquestioned, but whether this police supervision extends farther than keeping the regular channels of navigation open may seriously be doubted. However this may be, it is certain that neither State nor municipal governments have any authority whatever beyond the shore mark of high tide. As in many other cases where entirely new conditions arise, the matter will eventually have to be decided by public opinion.

A single float exhibiting an electric sign and anchored off shore, or propelled by licensed navigators, could hardly be called an obstruction or menace to navigation. The real question is, what would happen if other similar enterprises were inaugurated to an unlimited extent? Suppose, for example, that instead of one there was a whole marine parade of such barges passing back and forth in front of this or any other resort every night when the weather permitted. Would it be one of the spectacles which people would gather to see, or, by obstructing the view of the ocean itself, would it become an intolerable nuisance? There are probably a large number of people who would line up on each side of the argument.

The scheme is an original and daring one, and something ought to be always conceded to originality. The very high advertising value of the electric sign is further proven by the proposed plan. If the promoters of this scheme are balked by the government, why not try attaching an electric sign to an aeroplane?

Metric System to Be Used in Papers Presented Before the Illuminating Engineering Society

At the regular meeting of the Council held on June 9, 1910, it was resolved that wherever practicable, metric equivalents be placed in parentheses after English measures in technical papers presented before the Society. By this means it is hoped to familiarize readers with the use of the metric system, and thus facilitate the ultimate adoption of that system.

Conventions Yet to Come

The Canadian Electrical Association will hold its twentieth annual convention at the Royal Muskoka Hotel, Muskoka Lakes, on July 6, 7 and 8. Everything is being done to make this convention a record breaker, with every prospect of success. The following gentlemen representative of the American electrical interests have signified their intention of being present, if possible: Messrs. W. W. Freeman, president of the National Electric Light Association; T. C. Martin, executive secretary National Electric Light Association; David B. Rushmore, of the General Electric Company, Schenectady, N. Y.; Ralph B. Mershon, consulting engineer, New York; Henry L. Doherty, New York, and Paul M. Lincoln, of the Westinghouse Electric and Manufacturing Company, Pittsburgh.

An excellent programme of papers is promised, and the location of the convention is all that need be said as to the possibilities for a delightful outing in combination with the instruction and exchange of ideas which these conventions make possible.

The National Electrical Contractors' Association will hold its tenth annual convention at Atlantic City July 20, 21 and 22. The headquarters will be at Young's Hotel and the sessions held on Young's Pier. There will be both public and executive sessions, and an exceptionally attractive social programme has been provided.

The electrical contractors have shown their ability to combine the public discussion of their business with the private consideration of such matters as are properly so treated, together with the best features of general social enjoyment.

The convention this year should be a success in every way, expressing the general progress in the electrical industry which this association represents.

Notes and Comments

A review of the procession of cities that are marching on to better public lighting.

GRAND AVENUE IS TO BE WHITE WAY

PROPERTY OWNERS AGREE TO INSTALLATION OF NEW LIGHTING SYSTEM.

The property and business owners on Grand avenue have agreed to install new lights.

The dream of the business men that the streets of Oklahoma City would have the best lighting system in the West now appears to be nearing reality, for within a week, according to Mr. Greenman, the posts and new lights will be installed.—*Oklahoma Times-Journal.*

GERMANTOWN WANTS LIGHTS

BUSINESS MEN ASK FOUR WHERE THERE IS ONE NOW.

After a discussion of better lighting in Germantown avenue, the Germantown Business Men's Association decided to appeal to the Mayor and City Councils to remedy the present conditions. The business men want a light about every hundred feet instead of every four hundred, as at present.—*Philadelphia Press.*

WANT MORE LIGHT AT OCEAN CITY

A committee from the Hotel Proprietors' Association, of which J. W. Sims is chairman, has suggested to council that it would be a good plan to illuminate the boardwalk each night with the incandescent bulbs from June 15 to September 15, and on Saturday and Sunday evenings between May 28 and June 15 and September 15 and October 1.—*Philadelphia Record.*

WORKING ON THE ILLUMINATION PLAN

Work is going forward to-day on the illumination scheme for Bridge street, Erie

avenue and Queen street. The wires are being strung and the lights will be turned on for the first time Saturday evening. The merchants are very enthusiastic over the scheme. A meeting of the merchants and the Mayor together with several Aldermen was held at the City Hall to-day to decide just how many lights would be required and to arrange some little details.—*Niagara Falls Gazette.*

CITY WILL BOOST "GREAT WHITE WAY"

CITY ATTORNEY TO DRAFT ORDINANCE TO PROVIDE FOR EXPENSE.

The City Council chamber was well filled last evening with all the Aldermen present, and the rear of the room crowded with delegates from the Commercial Club, who wished the Council to take action toward the city's maintenance of the "Great White Way," it being generally conceded that if such action is taken there will be no trouble in getting the posts installed in the blocks needed.

A motion was finally passed that the matter be referred to the City Attorney with orders to draw up an ordinance in accordance with the desires of the Commercial Club, which are that the city maintain all of the lights instead of the present arc lights, which will not be needed with the "White Way."—*Fargo News.*

WILL ILLUMINATE MICHIGAN STREET

NEW LIGHTS WILL BE INSTALLED FOR TWO SQUARES.

SCHEME IS CONTINUATION OF SYSTEM BEGUN IN PLACING OF LAMPS ON WEST WASHINGTON AVENUE.

A system of ornamental street lights just installed on West Washington avenue will be continued north and south on Michigan street at once, according to an announcement made to-day. Merchants and others in business along the street between Jefferson boulevard and Colfax avenue have engaged lights and they will be installed just as rapidly as possible. Ultimately it is the hope of those behind the movement to extend the system until the entire business district is equipped with the uniform scheme of illumination.—*South Bend, Ind., Tribune.*

LIGHT BROAD STREET

It now seems that Broad street will speedily have the more elaborate and extensive scheme of lighting that has been planned for it. The Finance Committee recommended an appropriation of $20,000 for this purpose.

Broad street is already a splendid and beautiful thoroughfare, but it is destined soon to become the "Great White Way" of the South.—*Richmond, Va., Times-Dispatch.*

DISCUSS NEW LIGHTING PLAN

The Aldermen last night discussed the idea of placing arches of tungsten lamps across Main street, to take the place of the present arc light system. The cost would be no more than at present—*Buffalo Express.*

EDGMONT AVENUE MERCHANTS TO HOLD MEETING

The Edgmont Avenue Business Men's Association will hold a regular meeting this afternoon. H. Thurston Owens, consulting illuminating engineer, of New York City, and a representative of the general Gas Light Company, of Kalamazoo, Mich., will be present, and will give practical talks on street illuminating by means of gas.—*Chester, Pa., Republican.*

COMMITTEE TO FAVOR STREET LIGHTING PLAN

ALDERMEN WOULD PERMIT ORNAMENTAL POLES AND ELECTRIC CLUSTERS IN WARREN STREET.

The Highway Committee of the Common Council have decided to report favorably on the petition of the Syracuse Lighting Company for permission to erect 14 ornamental poles, each bearing five electric lights, in Warren street between Fayette and Jefferson streets. The plan is to be supported by the business men of Warren street.

The block in question will be the most brilliantly lighted in Syracuse, having 90 lights on the 14 ornamental poles.—*Syracuse Post-Standard.*

BOARDWALK LIGHTING BY POSTS IN CENTER NEW ELECTRIC PLAN

COST AT LEAST $30,000.

New plans to illuminate the boardwalk by the erection of rows of standards at a roughly estimated cost of between $1000 a square to $1600 a square, with the standards 20 ft. apart, was introduced by Chairman Donnelly of the Lighting Committee in City Council. Three different plans for the new illumination were presented and referred to a further conference of Council.

All three plans contemplate the placing of two standards, bearing an arc light and a cluster of four incandescent lamps, 18 ft. high above the boardwalk level, at each street end, one standard being placed on the inner line of the boardwalk, the other opposite on the other line of the boardwalk. —*Atlantic City Review.*

CLUSTER LIGHTS FOR SEVENTH STREET

PROPERTY OWNERS OVER THERE FAVOR THE BEAUTIFUL NEW SYSTEM OF STREET LIGHTING.

Arrangements have been made by which Seventh street will be lighted by 75 cluster lights. Work will be commenced the first part of July or possibly sooner if the minute

particulars of the plans are accepted by the property owners.

There is a prospect that similar lighting will be provided on other business streets, State, Wyman and Main streets, and the business sections of town be made as light by night as in the day.—*Rockford, Ill., Republic.*

ROCKFORD BUSINESS MEN WANT MORE LIGHT

BUSINESS MEN OF EAST STATE STREET LIKELY TO ADOPT NEW ORNAMENTAL STREET LIGHTING SYSTEM IF OTHER STREETS GET IT—MANY SEVENTH STREET BUSINESS MEN WANT IT—WILL BE UP TO THE COUNCIL TO DECIDE WHETHER OLD ARC LIGHT SYSTEM SHALL BE DONE AWAY WITH.

Agitation favoring the installation of boulevard lights for all the principal business streets of Rockford is now on foot, the latest street to want the ornamental system of lighting being East State street.

There is likely to be very little, if any, opposition to the installation of boulevard lights among the merchants of East State street. One of the leading business men of that street said to the *Republic* this morning that if other streets put in boulevard lights East State street also wants them.

Thus far Seventh street has gone further with the matter than any of the other streets. Many merchants of Seventh street have agreed to the installation, providing permission can be secured from the City Council.

It is planned to light Seventh street from Charles street to Railroad avenue with the cluster lights on the ornamental posts. On East State street the posts are planned to begin at Third street at the corner of the new Peterson block and to extend down to the bridge and across to West State street to Winnebago street, and on Main street from Mulberry to Cedar streets and on Wyman from Chestnut to Mulberry streets.

The matter has not yet been brought into the Council, but petitions will soon be circulated and it will be up to the Aldermen for decision. Many cities have adopted the boulevard system, because it makes a city more beautiful and adds to the attractiveness of the window displays. Business men and residents in the district where the system is planned will probably agree to pay for the installation. They will pay for the ornamental posts and equipment and will request the city to pay for the light.—*Rockford, Ill., Republic.*

ILLUMINATE BANKS, MERCHANTS REQUEST

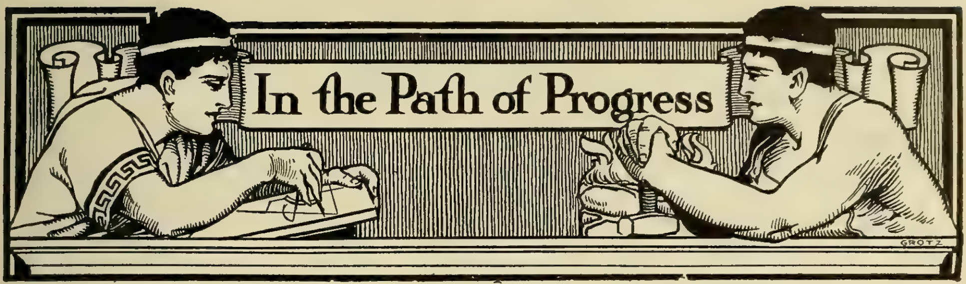
PRESIDENT KIMBALL TO PROPOSE NEW MOVE AT NEXT ASSOCIATION MEET.

Members of the Elgin Merchants' Association are planning to request all the Elgin banks to illuminate their offices every evening that the stores are open for business. President M. J. Kimball proposes to bring the matter before the association at its next meeting and it is believed that the banks will accede to the request.

"This suggestion was made to me by George L. Jackman," stated Mr. Kimball today, "and I consider it a very good one. I am especially appreciative of such forethought since it comes from a prominent Elgin citizen who is in no way interested in mercantile affairs.

"For the remainder of the summer, at least, Saturday nights will be the only nights that the banks will be asked to illuminate when their own doors are not open. Such illumination will add materially to the appearance of the downtown streets. Corners which have heretofore appeared dark and gloomy will be as bright as the other parts of the shopping district. I have no doubt that the banks will comply with our request."

Elgin merchants are greatly interested in the proposed lighting of the shopping district. They have agreed to install the lamps, and both the Merchants' Lighting Company and the Traction Company have agreed to provide electricity free for a certain length of time.—*Elgin, Ill., Courier.*



The Westinghouse Tungsten Lamp

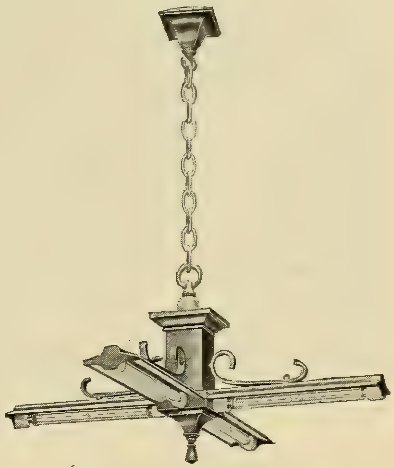
In a paper before the N. E. L. A. convention, which is reviewed elsewhere in this issue, Mr. Scott gives a very clear and interesting account of the design of the Westinghouse tungsten lamp, which is put out under the rather infelicitous commercial name of the "wire type." The description of the lamp, as well as the arguments put forth by Mr. Scott as to its advantages, are certainly both scientific and convincing.

The question of mechanical breakage in the metal filament lamp has been a serious one, and any method by which this fault, which at first seemed inherent in the material of the filament, can be obviated is therefore of the highest importance. From the results of laboratory tests it would appear that the method adopted by the Westinghouse Lamp Company, Bloomfield, N. J., has largely, if not wholly, overcome this deficiency. Reports from users of the lamp confirmed the results of these tests. Still further proof is the necessity for a large addition to the company's manufacturing plant in order to supply the constantly increasing demand for the lamp.

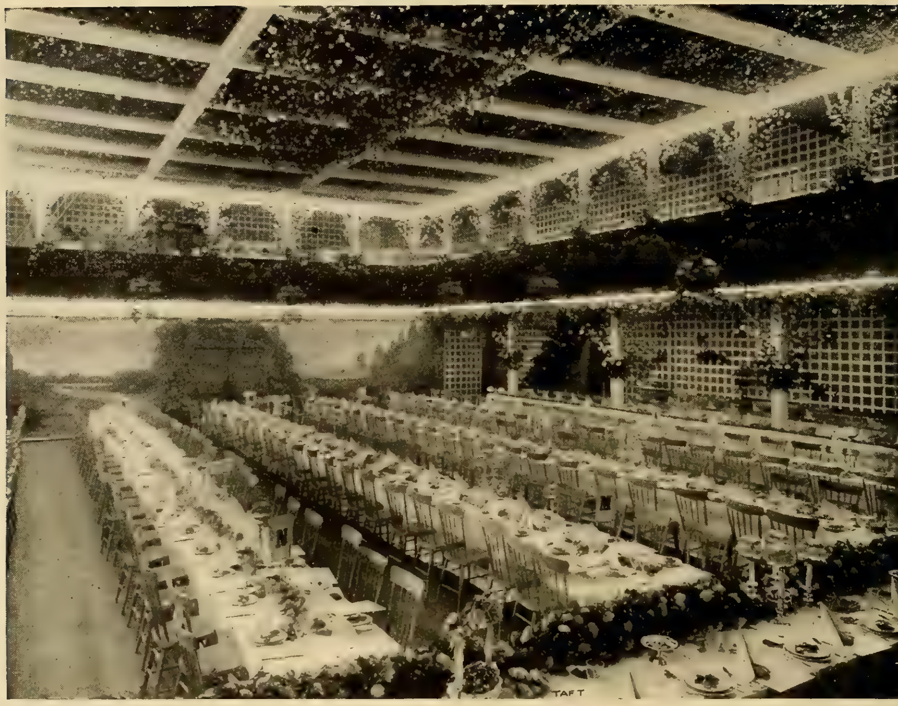
The engineering department of the Westinghouse Lamp Company is to be congratulated upon the success which has attended its efforts to solve this knotty problem.

An Unique Electrolier

Those who have assumed that the Linolite lamp was useful only in the comparatively limited field of show window and showcase lighting have failed to appreciate its great adaptability and wide field of usefulness for purposes of general illumination. The fact that by its peculiar construction the Linolite tungsten lamp can be run in series, and so take advantage of the stronger filament, longer life and greater efficiency of series operation, places it in a position to successfully compete with the bulb form of lamp in practically every instance. Added to these practical advantages it possesses the further merit of novelty, a matter of no little consequence in many cases. The special electrolier illustrated above is a hint at its possibilities in this direction; there is almost no limit to the unusual, artistic and efficient designs which can be utilized. The Linolite lamp needs only unprejudiced investigation to convince the most skeptical of its unapproachable advantages for many special cases, and its general excellence in a very wide field of application. These new fixtures can be had through any of the branches of the H. W. Johns-Manville Company throughout this country.



J-M LINOLITE ELECTROLIER.



VIEW OF HALL LIGHTED BY THE MOORE LIGHT AT TAFT DINNER, PASSAIC, N. J., MAY 9, 1910.

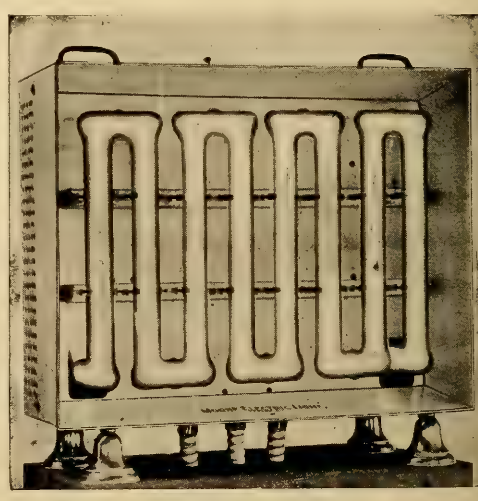
The Moore Light for Decorative Illumination

Since its first introduction a dozen years ago, Mr. D. MacFarlan Moore has always maintained that his light had peculiar advantages from the esthetic and decorative viewpoint. He has at last had an opportunity to show his faith by his works. At a banquet given at Passaic, N. J., at which President Taft was the guest of honor, the illumination was entirely by the Moore Vacuum Tube Light. That the result was both pleasant and artistic may readily be gathered from the inspection of the accompanying illustration.

The latest commercial device of the Moore Light Company is called the "Light Window," and its construction and advantages are thus set forth by the company:

The Moore Light Window is a factory-built type of apparatus placed upon the market during the past year. It is especially designed for installation in color matching departments of textile mills and other factories whose product is dependent on correct color values. It is also suitable for department and clothing stores, milliners, artists, cigar sorting, etc.

All apparatus is designed for the production of the Moore white light by means of electrically excited carbon dioxide within the glass tube. The tubing is 1¾ in. in diameter, the same size as that used in long tube



THE MOORE "LIGHT WINDOW."

installations of the Moore light. There are contained in each Moore Light Window 17 lineal feet of this glass tubing. The light-giving area is approximately 2 ft. square. The standard form of this light operates on 220 volts, 60 cycles alternating current and consumes about 2000 watts. It can be modified for operation on other voltages, and when direct current only is available a small motor generator may be utilized.

It is interesting to know that as a result of the installation of the Moore Light Window during the past fall and winter in mills within the vicinity of New York, 10,000 factory hands were enabled to work regularly, where heretofore they were compelled to be idle on dark days and late in the afternoon.

A New Insulating Material

Since electricity first began to be distributed commercially, the subject of insulation has been an important one. Glass, hard rubber and porcelain have long held supremacy, although innumerable efforts have been made to find substitutes that were either cheaper, or better, or both.

The latest result of these efforts to reach the commercial stage is a composition substance which was first worked out in Germany, and is now being manufactured in this country under the name of Hemit, from the name of the discoverer, Mr. Hemming. The product is known in Germany as "Gummon." It is claimed for Hemit that it has a specific resistance at least equal to unglazed porcelain; is neither consumed, warped, nor cracked by high temperatures, notwithstanding a red heat, or even the heat of the electric arc, for a considerable time; has not the brittleness of glass or porcelain; can be machined after being shaped; is pressed cold, thus permitting the insertion of metal parts; does not shrink or warp in the process of making, thus securing accuracy and uniformity in size, and can compete with glass and porcelain in price. These are surely a list of qualities which should insure it a very large use.

That the claims are well founded seems to be borne out by the actual experience with the material in Germany, where it has now been in use for four or five years. Certain of its qualities will enable it to entirely supplant, and in fact revolutionize, some lines of electrical fittings; lamp sockets may be among these.

The success of this material in America will be watched with keen interest by both electrical and illuminating engineers. It is being put out by the Hemming Mfg. Company, 2 Rector street, New York.

New Publications

"The Federalist" is the title of a house organ issued by the Federal Electric Company of Chicago. It contains twelve pages and cover, 5 x 7 inches, printed on coated paper, with a handsome cover design. Marginal notes are used as a key to the contents. It is set in a large, clear, readable type, and the illustrations are used for their practical value rather than as decorations. The commercial paragraphs are plain and to the point, and are interspersed with some really good quotations that are both witty and wise. "The Federalist" is a credit to the house which it represents.

"Data on Illumination" is the subject of the Bulletin No. 7B of the Engineering Department of the National Electric Lamp Association. Extensive tables for figuring the illumination of the various Mazda lamps and reflectors are given, also distribution curves. Other tables give the intrinsic brilliancy of different light-sources, the intensity of illumination required for various purposes, the coefficients of reflection for different colored walls and ceilings, the spacing of units for uniform illumination, and various information as to the carrying capacity of electric wire. It is an especially valuable pamphlet for illuminating engineers, the information given being such as to greatly facilitate the calculations of installations in which Mazda units are to be installed.

Announcements

The Federal Sign System (Electric) has opened a branch office in Pittsburg, Pa., at 3 Wood street, under the management of Mr. L. F. Bruce, to provide for the demand for Federal electric signs, fixtures and specialties in that district.

Mr. A. E. Payne, for the past eight years sales engineer for Stuart-Howland Company, Boston, has severed his connections with that firm and taken the management of the New England branch for the Excello Arc Lamp Company, established at 184 Franklin street, that city.

Proceedings of Technical Societies

The N. E. L. A. Convention

Six papers were presented at the convention which are of interest to illuminating engineers, as follows:

Industrial Lighting with Incandescent Lamps, by J. D. Hoit, P. F. Bauder and H. S. Hall of the National Electric Lamp Association.

The subject of industrial light is manifestly too extensive to be dealt with in detail in the space of a single paper. The authors, therefore, confine themselves to general recommendations. They classify industrial lighting under three heads: General, Specific (local) and Composite Illumination. They then divide the industries into six different classes and give the general conditions to be met in each class, and recommendations as to which of the three classes of illumination should be installed. An interesting feature of their paper is a table giving the results of a number of tests upon carbon filament lamps, showing the reduction in candle power and efficiency by the accumulation of dust and grime in use, and the percentage of increase when the same lamps were cleaned. The latter showed in some cases as much as 59 per cent., and averaged more than 25 per cent. As the title of the paper plainly indicates, the subject deals only with the use of incandescent lamps in industrial lighting, leaving entirely out of the question the use of all other units.

Residence Lighting, by Henry J. Gille, of the Minneapolis General Electric Company.

Mr. Gille starts out by impressing upon central station men the commercial importance of residence lighting:

"Residence lighting is among the most important subjects confronting central-station men to-day, as it is the largest undeveloped field for the use of our product. The development of this business has received little attention by central-station men until recently. Most of our development work has been centered on commercial lighting and power, which is probably due to the fact that it apparently produces larger returns on our investments."

After quoting facts and figures to substantiate his position and add impressiveness to his proposition that central stations should endeavor to secure a greater proportion of house lighting, the following very pertinent observations are made:

"Aside from the economic question of residence lighting, every public utility assumes an obligation when it undertakes to furnish the public with any service. The position it occupies in a community, therefore, depends not only upon its furnishing good service at reasonable rates, but upon how well it serves that community. We realize fully the necessity of occupying the territory, as the success of any public utility depends to a very large extent on the greatest good that will come to the greatest number. Therefore it must be evident that it is not only profitable but highly desirable to develop resident business. In order to accomplish this it is necessary that the public should understand our rates, our methods of production and distribution, the conditions surrounding the furnishing of service, and the best and most economical manner of using it, as well as the great benefit to be secured from its use.

"How can we best accomplish this? How can we expect the public to know all about these things unless we tell them? How are we going to get their confidence and support unless they understand, in some measure, the inside facts? The people are eager to learn; they are interested in things electrical. The only danger lies in the fact that they are likely not to learn the truth, and we should tell them the truth in language they can understand. This resolves itself into a question of education, covering not only the con-

ditions surrounding the furnishing of electric service but particularly the use of such service. People are not as familiar as they should be with the great comfort and many conveniences and benefits made possible through the proper installation and use of electric light and electric labor-saving devices in the home. They understand only in a general way the convenience, cheerfulness and cleanliness of electric light, and the desire for its use in a general way exists. This desire has been very largely increased during the last year through the introduction of high efficiency lamps and the advertising campaign carried on all over this country, not only by central-station companies but by manufacturers of lamps and other current-consuming devices."

Mr. Gillē then refers to the importance of considering color effects in domestic lighting, both from the psychological and commercial viewpoints. His comments on this subject are well worth careful consideration:

"Learned scientific men have put forth remarkable statements concerning the physiological influence of color. An eminent London physician spoke highly of the beneficial effect upon the nerves and the eye of soft-toned greens; vivid yellow produces exhilaration and confidence; violet tones have a tendency to depress; softened or broken white is quieting to the brain of the busy man; quiet tones in the sleeping room are soothing and delightful. The effect upon the brain where a color treatment has been carried out not consonant with the personality of the occupant is more serious than is generally realized, as it extends to the entire system. The constant dropping of water wearing a stone illustrates this action of color upon the nerves of the brain. The constant presence of irritating color is so real as to produce physical distress, and medical aid is often called in when what is really needed is a change of wall paper.

"Many houses are left in white for a year or more until the new plaster settles. In this condition a small unit of light is sufficient; but when the decorator completes his work, adding fabrics and wall paper which absorb and diminish the light, the consumer does not always comprehend why his lighting bills increase, being unaware that the cause is his taste for dark-colored furnishings. These facts must be understood to be remedied, and it remains for the illuminating engineer to learn by experiment the value of light as it affects or influences color, as well as the value of color as it affects light, in order to determine the amount of light required to produce the best results.

"The development of residence lighting, therefore, depends not on the economic question only, but upon the character of the light, its color influence and the structural character of its introduction."

Decorative Street Lighting, by E. L. Elliott, editor of The Illuminating Engineer.

In this paper an attempt is made to set forth in a few words the advantages to be gained by central stations in promoting decorative public lighting. The chief arguments in favor of this proposition are that public lighting is at present far behind interior lighting, both in efficiency and extent; that America is far behind European nations in its public lighting; that decorative street lighting popularizes good illumination and promotes good feeling between the consumers and the central station, and furnishes in itself a permanent addition to the revenues. The writer prefers ornamental lamp-posts to arches. Attention is also called to the importance of electric signs in the attractiveness of a "Great White Way."

The subject was illustrated by stereopticon views, showing typical installations. The paper was read and the views discussed by Mr. V. R. Lansingh in the absence of the author.

A New Form of Tungsten Lamp, by Charles F. Scott, of the Westinghouse Lamp Company.

In the lamp described the tungsten wire used to form the filament is hung freely over the wire supports in a continuous succession of loops throughout its entire length, instead of consisting of a series of hairpin-shaped loops rigidly attached on the bottom, as is the general construction in other makes of lamp. The writer argues that this method of suspension avoids breakage by sudden jar, and describes two very interesting devices for making mechanical tests to determine this point.

High Efficiency Lamps: Their Effect on the Cost of Light to the Central Station, by S. E. Doane, chief engineer of the National Electric Lamp Association.

Mr. Doane's paper is a very careful analysis of the rate question, with special reference to its relation to the high efficiency lamp. While the question does not directly concern the practicing illuminating engineer, it is one which is of considerable collateral interest.

The concluding paragraphs of the paper are especially suggestive:

"The effect of the high efficiency lamp has been to profoundly modify commercial practice. The possibility of these lamps being made more efficient as the weeks pass makes it necessary for the central station to adopt policies, programmes and methods which not only will take care of the present high efficiency lamp situation but which will provide for any increase in efficiencies in the weeks, months and years to come.

"Ductile tungsten wire has been produced, and it is a most reasonable expectation that the high-class tungsten filament lamps ultimately will be hardy and capable of satisfactory employment in houses or elsewhere where the supposed fragility has been argued against them. Every customer on a central-station circuit will ultimately purchase and use lamps of this character.

"The situation contains a menace and a promise—a menace which cannot be ignored, a promise which must be fulfilled.

"The menace is in the fact that the reduction in the cost of providing light to the average customer can never be so great as the customers expect.

"He inevitably associates that two-thirds reduction in current consumed with a two-thirds reduction in cost.

"The decrease in cost of furnishing light with the high efficiency lamp is almost entirely measured by the ability of the central station to take on additional consumers who can assist in bearing the fixed expenses.

"The promise lies in the opportunity.

"Never in the history of our industry has there been the opportunity which now presents itself to the central station for increasing the number of its customers, decreasing the cost to each of them, and increasing profit to itself through the use of the high efficiency lamps."

Periodic Lamp Renewal and Customers' Service Inspection, by A. G. Strickrott, of the Schenectady Illuminating Company.

The writer makes a very convincing argument for regular inspection of lighting service and installations used by the customers of the central station. His arguments and the results of his experience confirm the opinion previously expressed by The Illuminating Engineer, that regular attention on the part of the central station to the conditions of the service furnished affords the best possible opportunity to promote good will and increase business. The following extracts give the general purport of the paper:

"Many central-station companies, furnishing free lamps and renewals, feel that after the service has been established and the desired number of lamps supplied the installation will take care of itself, and that all that remains to be done is to furnish the energy with as few interruptions as possible and to provide some convenient station where lamps can be exchanged.

"From that time on little or no attention is given to the installation, and it is left entirely with the customers to obtain such results as they can through their own efforts. The only representatives of the company who call on them are the meter testers, from whose visits they do not expect to benefit, or a collector, whose presence is seldom acceptable, or possibly a representative of the "New Business Department," who is endeavoring to introduce an electric iron or other appliance. If the lighting service has not given entire satisfaction it will be a difficult matter to interest the customer in new devices and additions, and he will not care to make further application of the electric service. Literature pertaining to new devices is usually mailed to a customer with the monthly statement, at which time he may not feel in the best spirit toward the company, and often considers reducing the use of the service rather than adding additional current-consuming devices. As a result the literature is often cast aside and not even examined.

"Many companies have an information window, possibly in charge of a boy, whose duty it is to renew lamps returned by customers and attend to mailing and other miscellaneous work, and it is to him that complaints are entered, with little confidence of their receiving proper attention. Possibly the customer has been in line at the cashier's window and heard other complaints relative to the service and charges which substantiate his ideas, and he leaves the office even more dissatisfied than when he came. Complaints of high bills, etc., can be properly taken care of by having a private room in charge of a competent person, whose principal duty it is to handle matters of this kind; but complaints on service rendered and keeping the customers' good will require a visit to his premises for the purpose of investigating his local conditions of operation and giving him individual attention. The trouble may be due to one or more of the following: Burned out or blackened lamps, improper voltage, wiring overloaded, fixtures, glassware, controlling devices, lamps of insufficient candle power or improper use of lamps.

"As a matter of fact, the customer receives no attention unless he makes a complaint, and this having been done it is more difficult to satisfy him than if periodic calls had been made and the shortcomings of the service voluntarily attended to.

"No matter what conveniences may be offered in the way of lamp renewal stations, this matter does not receive proper attention from the customer. Lights which are oftenest used and on which the customer is most

dependent receive as a rule the same attention as those used occasionally.

"The rooms in a house are usually of different size and decoration, but this does not receive due attention on the part of the customer, who may use a certain size of lamp for all rooms, regardless of all conditions, and expect to obtain equally good results throughout. Many residences are furnished with inexpensive fixtures and improper glassware, which by no means improve but are all detrimental to the service. Sockets and switches become worn and loose and need adjusting or replacing. Although these could be easily repaired with the aid of a few tools, it is as a rule beyond the ability of the customer. Rather than call in an electrician, whose charges for such small jobs necessarily appear excessive to them, the matter is neglected and the value of the service correspondingly decreased."

Magnetite and Flaming Arc Lamps vs. Open and Enclosed Arc Carbon Lamps for Street Illumination, by W. D'A. Ryan, of the General Electric Company.

Mr. W. D'A. Ryan gave a graphic comparison of the 9.6-amp. open arc, the 6.6-amp. enclosed arc, the 4-amp. luminous arc, the 6.6-amp. luminous arc and the 6.6-amp. flaming arc lamp with vertical electrodes. In the order here indicated, these lamps give 0.8, 0.9, 1.1, 1.4 and 3.6 mean spherical candle power per watt, or 1.2, 1.7, 1.7, 2.6 and 5.8 mean lower hemispherical candle power per watt. At a distance of 250 ft. from each lamp the illumination would be 0.0041, 0.0041, 0.077, 0.016, 0.031 foot-candles. The distances for equal illumination would be 250 ft., 285 ft., 315 ft., 475 ft. and 637 ft.

Test results, such as just outlined, seem to indicate that one 6.6-amp. flame arc lamp is equal to two 6.6-amp. luminous arc lamps, for 4-amp. arc lamps, five 6.6-amp. enclosed arc lamps and seven 9.6-amp. open arc lamps when used for street illumination.

Report of the Lamp Committee, W. F. Wells, chairman; John F. Gilchrist, Percy Ingalls, W. H. Johnson, Frank W. Smith, F. S. Terry, E. E. Witherby.

The following extracts from this brief report are of interest to illuminating engineers:

"For residences, office desk lights, window strip lighting or any use where smaller units are desired, the 25-watt and 40-watt small bulb lamps are most suitable, as they will in most cases fit the shades and fixtures of lamps with carbon filaments, and give the same or increased candle power for a smaller amount of energy.

"For cluster work in groups of three to six for the lighting of large areas, such as stores, auditoriums, etc., the 60-watt is probably better adapted. This lamp, however, should be frosted, unless used with a special globe to tone down the intrinsic brilliancy of the light.

"For small stores requiring inexpensive wiring, with a limited number of outlets, the 100-watt lamp is most economical, 200-watt or 160-cp. capacity in this lamp costing only about one-half the same capacity in 25-watt lamps. These lamps should have proper shades and be bowl frosted, except where the customer demands brilliant light instead of illumination. Lamps of the 150-watt, 200-watt and 250-watt sizes have been used in special cases for replacing arcs or where large units are desired.

"The experience of companies which have pushed the use of tungsten lamps has been that there is first a notable decrease in revenue. As a rule, however, the customer purchases illumination to fit his purse, and he is apt within a short time to so increase his installation as to approach his original expenditure for light. The reduced cost of light brings additional customers, and the effect on the total revenue will no doubt be an ultimate increase.

"Reports from the companies indicate that a very large amount of new business has been obtained from customers who were formerly exclusive users of gas, the tungsten type of lamp making it possible to satisfactorily compete with gas at prevailing rates."

Report of the Committee on Progress, by T. Commerford Martin, chairman.

Mr. Martin's *résumé* of the progress of the electrical industry for the year has been considered an authoritative and valuable document since he first undertook the work.

In this last report seven pages are devoted to the subject of street lighting, in which its remarkable progress in this country during the past year is set forth. Special reference is made to the work done in Washington, Providence, Aberdeen, S. D., Albert Lea, Minn., Aurora, Ill., Mishiwaka, Ind., Grand Rapids,

Mich., Norfolk, Va., Wilkes-Barre, Pa., Van Wert, O., Chicago, New York and Denver. In all of these cases there are some particular features which render them of special interest.

Five pages are devoted to metallic filament lamps and four to arc lighting.

Under the last head the titanium carbide lamp, the new mercury lamp of Steinmetz, and the quartz tube mercury lamp are described. The first and last of these have been previously described in our columns.

The Steinmetz lamp is thus described by Mr. Martin:

> An interesting and novel type of arc lamp, due to Dr. Steinmetz, is that in which mercury is used as one electrode, in association with either iron or aluminum. The light from mercury alone would not be suitable for general application owing to the marked absence of the yellow, orange and red light waves. The color can be modified to a satisfactory extent by introducing salts of one of the halogen group, preferably iodin. The use of the halogens is of special value when the arc exists in a completely closed vessel capable of excluding moisture. The inventor proposes the use of meta-silica of lithium, which dissociates in the temperature of the arc, whereupon the lithium is free to produce the desired color, while the chemical activity of the radicals is more or less neutralized, each by the other, owing to the fact that they exist in the ionized state. The various silica salts formed on the inner surface of the tube are transparent, or at least translucent, and the only effect is to give to the inside of the tube a frosted appearance, similar to that of the well-known frosted incandescent lamps. This action does not cut down the light to any serious extent, particularly in view of the very high efficiency of the lamp, and only serves to cause the tube to present the appearance of a solid source of uniform and agreeably diffused light.

The Illuminating Engineering Society

Incandescent Lamps as Standards of Luminous Intensity, by C. H. Sharp and P. S. Millar; presented at the meeting of the New York Section, June 9.

An authoritative review of the conditions that should be observed in the preparation and preservation of the incandescent as a standard illumination. The paper is too condensed to admit of being abstracted.

Photometric Units and Nomenclature, by Dr. Edward B. Rosa; read before the New York Section, June 9.

This paper is a valuable contribution to a subject which in itself is important, and which has admittedly been in a more or less unsatisfactory state since photometry became a commercially important branch of mensuration. Dr. Rosa explains the various photometric units by analogy to electrical units. His definitions are exceptionally clear and concise, and his explanations, though derived from formulæ involving higher mathematics, are so clear as to be understandable even by the layman.

ILLUMINATING ENGINEERING SOCIETY

Illuminating Engineering Course at Johns Hopkins University

As announced in the accompanying circular issued by the Johns Hopkins University, Baltimore, a course of thirty-six lectures on Illuminating Engineering, extending from October 26 to November 8, 1910, will be given at that university. This course of lectures has been arranged upon the initiative of the council of the society, which by resolution decided to organize such a course and appointed a committee to take the necessary steps to that end.

The lectures, which will be given under the joint auspices and control of the society and the university, will follow immediately the annual convention of the society which, upon the invitation of the president of the Johns Hopkins University, will be held at that institution beginning Monday, October 24, 1910.

The course of lectures, the three-fold object of which is stated in the announcement of the university, should merit the support of those interested in illuminating engineering, to all of whom the course is open on equal terms. The scope of the lectures, together with the list of lecturers, should insure a large and representative audience. Cards of admission to the course, and information regarding the facilities for individual laboratory work, can be secured upon application to the registrar of Johns Hopkins University or the general secretary of the Illuminating Society.

Committee on Lectures:

Louis Bell,
W. H. Gartley,
L. B. Marks,
C. H. Sharp,
W. D. Weaver,
E. P. Hyde, Chairman.

May 23, 1910.

THE JOHNS HOPKINS UNIVERSITY, BALTIMORE

A Course of Lectures on Illuminating Engineering

The Johns Hopkins University offers for the academic year 1910-1911 a course of thirty-six lectures on the science and art of Illuminating Engineering. This course owes its origin to the following considerations:

The Illuminating Engineering Society recognizing the fact that there is an increasing demand for trained illuminating engineers and that the present facilities available for the specialized instruction required are inadequate, determined, through an act of the council of the society, to encourage the establishment of a course of lectures on the subject of illuminating engineering. This course should have three objects: (1) to indicate the proper co-ordination of those arts and sciences which constitute illuminating engineering; (2) to furnish a condensed outline of study suitable for elaboration into an undergraduate course for introduction into the curricula of undergraduate technical schools, and (3) to give practicing engineers an opportunity to obtain a conception of the science of illuminating engineering as a whole.

Inasmuch as such a course is most appropriately given at a university where graduate instruction is emphasized, and as the Johns Hopkins University has regularly offered courses by non-resident lecturers as part of its system of instruction and is now preparing to extend its graduate work into applied science and engineering, an arrangement has been effected by which the lectures will be given at this university under the joint auspices of the university and the Illuminating Engineering Society. The subjects and scope of the lectures have been proposed by the society and approved by the university. The lecturers have been invited by the university upon the advice of the society.

The programme of lectures together with the list of lecturers is given below.

The university will provide facilities for demonstrations at lectures and will also have installed a working exhibit of apparatus for experimental work in light, illumination and illuminating engineering. This apparatus will be at the disposal of those who attend, and an opportunity will be afforded to undertake laboratory work during the term of the lecture course under the supervision of trained experts of the university and of the society.

A fee of $25 will be charged for admission to the course and to the accompanying laboratory instruction. The complete course of thirty-six lectures will be given between the dates October 26 and November 8, 1910, inclusive.

Lectures on Illuminating Engineering.

1. The Physical Basis of the Production of Light. Three lectures. Joseph S. Ames, Ph.D., Professor of Physics, the Johns Hopkins University.

2. The Physical Characteristics of Luminous Sources. Two lectures. Edward P. Hyde, Ph.D., President, Illuminating Engineering Society; Director of Physical Laboratory, National Electric Lamp Association.

3. The Chemistry of Luminous Sources. One lecture. Willis R. Whitney, Ph.D., Director of Research Laboratory, General Electric Company; Past President, American Chemical Society.

4. Electric Illuminants. Two lectures. Charles P. Steinmetz, Ph.D., consulting engineer, General Electric Company; Professor of Electrical Engineering, Union University.

5. Gas and Oil Illuminants. Two lectures. (1) M. C. Whitaker, B.S., M.S., Professor of Industrial Chemistry, Columbia University. (2) Alexander C. Humphreys, M.E., Hon. Sc.D., President of Stevens Institute of Technology; Past President, American Gas Institute.

6. The Generation and Distribution of Electricity, with Special Reference to Lighting. Two lectures. John B. Whitehead, Ph.D., Professor of Applied Electricity, the Johns Hopkins University.

7. The Manufacture and Distribution of Gas, with Special Reference to Lighting. Two lectures. (1) A. G. Glasgow, M.E., M.I.C.E., London, England. (2) Mr. Walter R. Addicks, Vice-President of Consolidated Gas Company, New York.

8. Photometric Units and Standards. One lecture. Edward B. Rosa, Ph.D., Physicist National Bureau of Standards.

9. The Measurement of Light. Two lectures. Clayton H. Sharp, Ph.D., test officer, Electrical Testing Laboratory, New York City; Past President, Illuminating Engineering Society.

10. The Architectural Aspects of Illuminating Engineering. Two lectures. Walter Cook, A.M., Vice-President, American Institute of Architects; Past President, Society of Beaux Arts Architects.

11. The Decorative Aspects of Illuminating Engineering. One lecture. Mr. Louis C. Tiffany, President of the Tiffany Studios, New York.

12. The Physiological Aspects of Illuminating Engineering. Two lectures. P. W. Cobb, B.S., M.D., Physiologist of the Physical Laboratory of the National Electric Lamp Association.

13. The Psychological Aspects of Illuminating Engineering. One lecture. John B. Watson, Ph.D., Professor of Experimental Psychology, Johns Hopkins University.

14. The Principles and Design of Interior Illumination. Six lectures. (1) L. B. Marks, B.S., M.M.E., Consulting Engineer, New York City; Past President, Illuminating Engineering Society. (2) Mr. Norman Macbeth, Illuminating Engineer, the Welsbach Company.

15. The Principles and Design of Exterior Illumination. Three lectures. (1) Louis Bell, Ph.D., consulting engineer, Boston, Mass;

Past President, Illuminating Engineering Society. (2) E. N. Wrightington, A. B., Boston Consolidated Gas Company.

16. Shades, Reflectors and Diffusing Media. One lecture. Van Rensselaer Lansingh, B.S., general manager of Holophane Company.

17. Lighting Fixtures. One lecture. Mr. Edward F. Caldwell, senior member of firm and designer, Edward F. Caldwell & Co., New York.

18. The Commercial Aspects of Electric Lighting. One lecture. John W. Lieb, Jr., M.E., third Vice-President of New York Edison Company; past president, American Institute of Electrical Engineers.

19. The Commercial Aspects of Gas Lighting. One lecture. Walton Clark, M.E., President of the Franklin Institute, Philadelphia; third Vice-President, United Gas Improvement Company, Philadelphia.

The laboratory demonstrations will be under the direction of Charles O. Bond, manager of Photometric Laboratory, United Gas Improvement Company, Philadelphia; Herbert E. Ives, Ph.D., Physicist, Physical Laboratory, National Electric Lamp Association; Pretson S. Millar, Electrical Testing Laboratories, New York; General Secretary, Illuminating Engineering Society.

Cards of admission may be obtained by application to the Johns Hopkins University.

May 19, 1910.

American Institute of Electrical Engineers

Some Developments in Modern Lighting Systems, by C. W. Stone; presented at the annual meeting of the American Institute of Electrical Engineers, May 17.

Mr. Stone's paper deals largely with the technical developments of electrical generation and distribution since the electric light first became commercially used.

Metal Filament Lamps, by John W. Howell; read before the American Institute of Electrical Engineers, New York, May 17.

Mr. Howell's paper is a general history of the tungsten lamp from its first conception to the drawn wire lamp, which has not yet become a commercial article. The sources, characteristics and method of preparation of the metal and filaments are given, together with a description of the methods of testing and rating the lamps. Mr. Howell rightly contends that ratings for comparison should be of spherical candle-power rather than by horizontal.

Ductile Tungsten, by Dr. W. D. Coolidge; read before the American Institute of Electrical Engineers, May 17.

After describing the various research work carried out to produce the desired results the writer states that it is now possible to prepare the metal so that it can be worked without any other difficulties than would naturally pertain to the working of any metal into very fine wire. The product is a perfectly pliable, ductile wire having the tensile strength of steel. The filaments made from this wire retain their pliability throughout their life.

Miscellaneous

Residence Lighting, by R. W. Clarke; a lecture delivered before the Electrical Engineering Department of the University of Minnesota, May 18.

Mr. Clarke is the assistant commercial agent of the Minneapolis General Electric Company, and is, therefore, well qualified to speak on the subject. He maintains that residence lighting, far from being an undesirable class of business for the central station, is profitable, measured both in dollars and cents and in advertising value. The following excerpts are especially worthy of the attention of illuminating engineers:

In recent years the central station companies have been giving increasing attention to residence lighting as a profitable load. This class of business has been often looked upon as unprofitable because of the scattered areas which must be served, and because of the low load factor of the individual customer. Residence lighting has often been looked upon as a losing proposition and a necessary evil, to be endured only because of franchise requirements, commercial lighting being looked upon as the principal source of profitable revenue.

More careful investigation shows that residence lighting may be made profitable both from its direct income and also from its advertising value.

Since the central station companies have begun to appreciate more fully the value of residence lighting they have been engaged in vigorous missionary propaganda. In most cases this is being done, not by throwing mud

at other kinds of light and heat, but rather by calling attention to the great advantages of electric appliances. Something like 30 distinct advantages may be claimed in favor of electricity for lighting alone.

More progressive central station companies are reducing their prices as rapidly as possible in the belief that their best interests are identical with doing the most good to the greatest number of customers. Every effort is being made not only to reduce the cost per kilowatt hour to the lowest practicable limit but also to help the customer to get the maximum benefit from each kilowatt hour, believing that this is both good business policy and also most effective advertising. The aim is first to make electricity the most satisfactory illuminant, and, second, to make it as economical as possible.

Some companies provide experts who cooperate with householders, and when possible with architects, in seeing that the outlets are properly located and that they have sufficient capacity, special attention being given to the convenient location of switches. Liberal design in wiring is looked upon as an investment. For example, a wall switch conveniently placed, costing about $2 installed, will often save half and even all its cost each year on account of the greater convenience of extinguishing lights when not actually needed. At least one case is known where the installation of a well planned electric lighting system removed the demand for a new home. Three-way switches are a great convenience for controlling the same outlet from several sources, such as the lower and upper hall. Progressive illumination may be readily secured by the judicious use of wall switches so that by pushing adjacent buttons one may leave darkness behind and have light ahead. By arranging these switches systematically, members of a household will soon learn to push the buttons almost unconsciously so as to move the light along with them. Baseboard receptacles should also be provided liberally, such as for heaters in the bathrooms, toaster or special lighting in the dining room, table lamps in the living room as well as electric fans, and cooking utensils in the kitchen. The kitchen is lighted more hours than any other room in the house and should have convenient switches. Bedrooms should usually be lighted by center lights on the ceiling, auxiliary lighting being obtained from wall brackets, also by portables or brackets on the posts of the dresser, these being supplied through a cord from the baseboard receptacle. This plan allows rearrangement of the furniture at will. The more important rooms, such as the living room and dining room, should have two-stage or three-stage lighting.

The Physical Production of Light, by Dr. Edw. P. Hyde; read before the Franklin Institute, March 10.

This is a comprehensive review of the subject, and is considered under the following headings: 1, Physiological Optics; 2, Laws of Radiation; 3. Methods of Studying Selectivity; 4, Two New Photometric Methods of Studying Selectivity; 5, Procedure and Results of Various Metals and Carbon; 6, *Résumé* of New Photometric Methods and Results.

Dr. Hyde's first statement is at variance with the views of Dr. Rosa, given in his paper on "Photometric Units" before the Illuminating Engineering Society. Dr. Hyde says: "Light is a sensation. If there was no eye to see there would be no light, however many sources of radiation might be present." Dr. Rosa says: "Light, as we ordinarily say, is the physical stimulus which applied to the retina produces the sensation of light. It is equal to the radiant power multiplied by the stimulus coefficient."

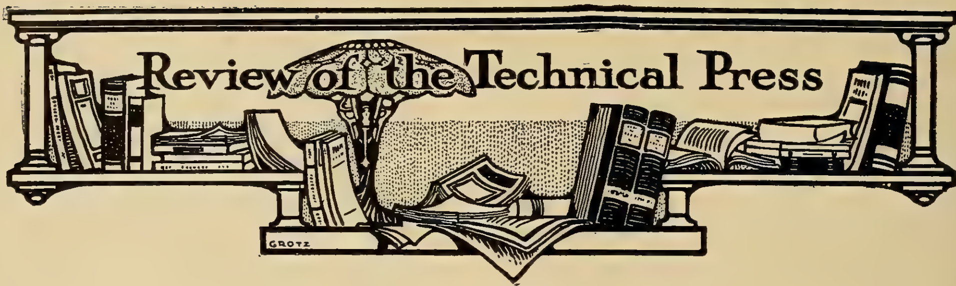
It is plain that the two authorities have simply taken the two meanings of the term light, Dr. Hyde using the physiological and Dr. Rosa the physical phenomena as the basis for their definitions. This is a common ambiguity in the use of the term, which it would be well to avoid.

In the case of the other primary forms of energy, as heat, sound and electricity, the name is applied to the physical cause rather than to the physiological effect. It would therefore seem better to take Dr. Rosa's definition of light rather than that given by Dr. Hyde.

The paper treats the subject in a purely scientific and technical manner, and is therefore chiefly valuable to the investigator or student of pure science.

A Comparison of Systems for the Illumination of Cars, by L. R. Pomeroy; read before the February meeting of the Canadian Railway Club; abstracted in the *Railway Electrical Engineer*, May.

This paper is a very careful analysis, giving photometric curves and data of the following methods of lighting railway coaches: Pintsch flat flame; Pintsch mantle, acetylene, tantalum electric and carbon electric. The methods also include all possible positions for the lamps. It is the most complete review of the subject that has thus far appeared.



American Items

The Bearing of Reflection on Illumination, by A. S. McAllister; *Electrical World*, May 26.

The article is a continuation of an article on the "Absorption of Light Method of Calculating Illumination," contributed by the same writer to the *Electrical World* of November 21, 1908. Mr. McAllister's treatment of the subject is too concise to admit of abridgment, and is worthy of a careful study in full.

The Illumination of Very Large, High Rooms, by James R. Cravath; *Electrical World*, June 23.

The article describes the illumination of the new gymnasium of the Northwestern University at Evanston, Ill., the lighting of which, the author states, called for some special study in new methods of artificial illumination. The plan decided upon was a combination of direct and indirect lighting. The article is written from the engineering standpoint, and gives complete numerical data in regard to the calculation and design of the installation.

Getting Light Into Dark Corners, by Albert Walton; *Factory*, June.

In the opening paragraph the writer gives the following as the ideal of perfect illumination: "The most effective way to light a machine is to place it on a glass platform 30 ft. above ground in the middle of a big field on a cloudy day. Under such conditions every surface of the machine will be evenly illuminated, and there will be no heavy shadows on any part of it. Of course, there will be difference of intensity of light on the various portions, but this is desirable for the best results, since an absolutely uniform distribution would make all surfaces appear flat. It is in keeping this difference within reason that good illumination consists." The balance of the short article tells how tungsten units have been successfully used for factory lighting.

Where to Locate Light Fixtures, by J. T. Carpenter; *Factory*, July.

The writer divides factory illumination into three classes: Aisles and passageways, machinery and tools, benches and hand operations.

The writer briefly describes the illumination of a large silk mill with mercury vapor lamps, in which he states that a total of 239,000 candle power is furnished with a power consumption of only 5 kilowatts more than was required with a former type of lighting (carbon filament lamps), which furnished only 35,000 candle power.

The illumination of a leather assorting room and a meat packing room with tungsten lamps is also described.

A Convenient Form of Quartz Tube Mercury Lamp, by Charles T. Knipp; *Physical Review*, May.

A short article describing a form of lamp designed by the author for use in experimenting with bacteria.

Notes on the Reflecting Power of Tantalum, Tungsten and Molybdenum, by W. W. Coblentz; *Physical Review*, May.

The article is a report of the study of selective emission from the different

metals by a study of the reflecting power of the metals when cold.

HANGING A DINING ROOM DOME, by Norman Macbeth; *National Commercial Gas Association Bulletin,* April.

Gives illustrations and diagrams showing how to properly install a dome fixture with inverted mantle gas lamps.

AN EASILY CONSTRUCTED MERCURY VAPOR LAMP, by E. M. Symmes; *Electrician and Mechanic,* June.

The writer states that "a mercury vapor lamp may be easily constructed by an amateur with the aid of a very simple apparatus by making use of the principle of the Toricellian or barometric vacuum. He then gives specific directions for carrying out this plan.

A FEW SUGGESTIONS TOWARD GOOD OFFICE LIGHTING, by Ralph Beman; *Building Management,* June.

A discussion of methods of office lighting by tungsten lamps and prismatic reflectors.

FLAMING ARCS IN A LUMBER YARD; *Electric City Magazine,* June.

The equipment in this case consists of four flaming arc lamps mounted six feet above the top of each of the tall masts used in connection with cranes for handling lumber. Owing to the height of the lamps the illumination is fairly uniform, and the shadows so short as to be of little annoyance, thus enabling lumber to be handled by night as well as by day.

GAS ARCS IN FACTORY LIGHTING, by Edward F. Kelly; *Progressive Age,* June 15.

This is article No. 1 in a prize competition offered by this journal for essays on "Gas Arc Lighting." Without reference to other contributions in the contest, the article, both from the manner and matter of treatment, is certainly worthy of the honor bestowed upon it.

Mr. Kelly was formerly a salesman for a gas company, and is now a consulting illuminating engineer, and is, therefore, familiar with both the commercial and engineering sides of the problem. He sums up the merits of the gas arc as follows: 1, it is the nearest to daylight; 2, it is the highest in efficiency; 3, it costs less to install; 4, it costs less to operate; 5, it costs less to maintain.

This list assuredly does not leave much ground for its competitors to occupy.

Mr. Kelly contends that the factory is not only the largest field for the use of the gas arc, but that it possesses sufficient advantages to give it a natural monopoly of the situation, if rightly pushed. He calls attention to the importance of having the best possible illumination for workmen, and lays stress upon the necessity of proper installation of lamps, giving proper distribution of illumination, stating that the salesman should know something of illuminating engineering principles.

The following intensities of illumination are recommended: On a work bench, 5 to 16 foot-candles; in a machine room, 5 to 10 foot-candles; in a store, 4 to 7 foot-candles.

Foreign Items

COMPILED BY J. S. DOW.

ILLUMINATION AND PHOTOMETRY.

RECENT DISCUSSIONS OF THE ILLUMINATING ENGINEERING SOCIETY IN LONDON.

Reference was made in the last review to the discussion of the Illuminating Engineering Society on "Glare" and "The Measurement of Light and Illumination." The meeting of the society on April 14th was devoted to the latter subject, one interesting item being the presentation of a paper by Dr. W. E. Sumpner on "The Measurement of the Total Light from a Source." Dr. Sumpner suggests the use of a cubical box in place of the Ulbricht globe; this, while much

easier to construct, should, he thinks, prove as accurate in practice. The account of this meeting and Dr. Sumpner's paper will be found in the May number of the *Illuminating Engineer* (Lond.).

The first annual general meeting of the society was held on May 23rd, thus concluding the first year's work. A report of the council was presented on this occasion. The situation looks very hopeful, as there is ample evidence of a growth of interest in matters connected with illumination and in the work of the society. The membership in the first year has grown from 150 to 225. It is also gratifying to note that Prof. S. P. Thompson has kindly consented to accept the presidency for a second term of office.

After the purely formal business of the meeting had been concluded Mr. Haydn T. Harrison and Mr. J. S. Dow described two new forms of photometrical instruments. The feature of Mr. Harrison's instrument is that no movement of the parts is necessary to get a reading. One merely looks at an illuminated graduated scale and notes the point at which the bright strip fades into equality with the part illuminated by the lights in the room. Thus the apparatus can be stood up against a wall or placed on the table, or in any position where a measurement is desired.

Mr. Dow's instrument is intended to measure surface brightness, the surface examined being observed through an aperture in an illuminated screen. It is anticipated that the instrument will be useful in cases in which it is inconvenient to place an actual illumination photometer in the place where a test is to be made; for example, in studying the illumination through a shop window or inside a glass case, etc., and, in short, in any case in which one wants to know the brightness or the illumination of a surface at some distance. The proceedings at this meeting are referred to in various papers (*G. W.*, May 28; *J. G. L.*, May 24, 31; *Electricity*, May 27; *Elec. Times*, May 26, etc.).

Erlauterungen zu den Normalen fur die Beurteilung der Beleuchtung, by Dr. L. Bloch (*E. T. Z.*, April 14).

The sub-committee on Photometry of the Verband Deutscher Elektrotechniker in Germany have recommended that all measurements of illumination, both indoors and out, should be made in a horizontal plane, one meter above the ground. The author gives the reasons for this suggestion, which is to be put forward at the annual meeting, with a view to tentative adoption for one year. The co-operation of the Verein von Gas und Wasserfachmannern, with a view to any possible modifications, is also being invited.

The Distribution of Energy in the Spectra of Artificial Illuminants, by W. W. Coblentz (*Illum. Eng.*, Lond., May).

A general study of spark and metallic spectra, concluding with a summary of the position as regards the production of light and luminous efficiency.

Illumination: Its Distribution and Measurements, by A. P. Trotter (continued; *Illum. Eng.*, Lond., May).

Deals with the Weber and Sharp-Millar photometers. Also discusses in some detail the nature of the illuminated screen in the latter instrument.

Illumination Requirements and the Lighting of Streets (*J. G. L.*, May 24; *G. W.*, May 14).

Street Lighting (*Elec. Rev.*, May 6).

The Lighting of Westminster (*J. G. L.*, April 26; *Elec. Times*, May 5, 12, etc.).

The three articles above are devoted to the discussion of the recent decision of the street lighting committee of Westminster to light Piccadilly and the adjacent neighborhood by gas instead of electricity.

The Local Government Board and Street Lighting (*Electrician*, May 20).

The position of the local government board with regard to street lighting still receives comment. It is again pointed out that if this authority means to take an increasing interest in the local decisions as to lighting it should be backed by adequate impartial expert support.

RESIDENCE LIGHTING (*Electrical Field,* May).

The author summarizes the chief points to be observed in connection with the lighting of the various rooms in private houses. Special stress is laid on the direction and distribution of light. A householder is impressed by the value of a lamp having double the efficiency of the older types. Ought he not also to appreciate the importance of effective shading by means of which the light can be concentrated in a given direction and the illumination, for a given cost, considerably increased?

THE LIGHTING OF THE NEW SOUTH KENSINGTON MUSEUM (*Illum. Eng.,* Lond., May).

ELECTRIC LIGHTING.

DIE GLUHLAMPENINDUSTRIE, by C. Basch (*E. T. Z.,* May 12).

LES COMPAGNIES ANGLAISES D'ELECTRICITE ET LES LAMPES A FILAMENT ELECTRIQUE METALLIQUE, by A. Bridge *l'Electricien,* May).

EIN VEREINFACHTES VERFAHREN ZUM SORTIEREN VON GLUHLAMPEN, by K. Keil (*E. T. Z.,* April 28).

Discusses a suggested method of classifying glow lamps based on a relation between the voltage and the corresponding candle power.

TESTING THE MECHANICAL STRENGTH OF METALLIC FILAMENTS, by T. Muller (*Electrician,* April 29; translation).

The author tests the strength of metallic filaments as follows: A small rubber ball is allowed to fall down an inclined plane and strike the lamp at the bottom. The distance which the ball must be allowed to roll before impact, in order to cause the filament to break by the concussion, is taken as a measure of its strength. The results for different makes, however, are somewhat uncertain.

LAMPE A ARC SOUS-MARINE, by F. C. Perkins (*l'Electricien,* May 28).

An account of a special arc lamp which is water tight and can be used for salvage operations under water, etc.

A THREE-PHASE ARC LAMP USING FOUR CARBONS, by A. Righi (*Atti della Assoc. Elettrotecnica Italiana,* March, 1910; *Lumière Electrique,* April 9).

The arc employs three carbons, each attached to a phase, and playing on an unattached insulated carbon. It is stated that a much steadier arc is so obtained, and that it can be used without objectionable flicker on periodicities below 15.

VERIFICATION DU VIDE DANS LES LAMPES A INCANDESCENCE, by L. Tiersot (*l'Electricien,* May 28).

DAS MOORE-LICHT, by W. Wedding (*E. T. Z.,* May 19).

The author gives a general description of the Moore system, specifying the efficiency of the CO_2 tube as 0.6 watts per H. K. He also describes a series of researches on the phase relations of the current and pressure under different conditions.

ELECTRIC LIGHTING BY METALLIC FILAMENT LAMPS (*Elec. Mag.,* May).

LES ORIGINES DE L'ECLAIRAGE ELECTRIQUE (*Rev. des Eclairages,* May 15).

GAS, OIL, ACETYLENE LIGHTING, ETC.

GASDRUCKFERNZUNDUNG, by F. Gohrum (*J. f. G.,* May 28).

The author summarizes the qualities which a good distance gas lighter must possess. He also describes the system in use in Stuttgart and explains how its introduction has been effectual in making, by saving in the consumption of gas and less breakages of mantles, an economy of 17,000 marks during the year.

GASSELBSTZUNDER, by W. Grix (*J. f. G.,* May 21).

Describes a self lighting device involving the use of a pellet of active material which incandesces in a stream of gas. The author points out that, in spite of its convenience, such apparatus must be absolutely reliable in order to give satisfaction and come into general use. One main reason for the gradual deterioration of such devices is that they suffer by con-

tinual exposure to the heat of the flame. Some arrangement must, therefore, be made to withdraw the pellet from the hot zone as soon as the flame is kindled. In the device described by the author this is accomplished by attaching it to a strip made of two metals having different coefficients of expansion. As they expand the strip bends sideways and removes the pellet outside the flame area, to a position in which it only undergoes a temperature of about 200 degrees.

COMPETITION IN PUBLIC LIGHTING SERVICE, by N. H. Humphreys (*J. G. L.*, May 25).

HIGH PRESSURE DISTRIBUTION PROBLEMS, by L. H. Johnson (*J. G. L.*, May 17).

PETROL AIR GAS, by W. Key (*J. G. L.*, May 24).

PRESSGASBELEUCHTUNG IN CHARLOTTENBURG, by O. Luckerath (*J. f. G.*, May 28).

Describes the public lighting arrangements by high pressure gas in Charlottenburg (Berlin). A pressure of 1400 mm. water is used. By means of an automatic distance lighting device one of the two mantles in each lantern is extinguished at 11 o'clock each night.

HIGH PRESSURE ACETYLENE PRACTICE, by M. Moskowitz (*Acetylene*, May).

FREE MAINTENANCE, by F. A. Whimshurst (*J. G. L.*, May 3).

BURNER MAINTENANCE (*J. G. L.*, May 10, 17).

The question as to how far a gas company can go in the direction of giving consumers free maintenance of their lighting apparatus is still receiving attention. In some quarters it has been suggested that this duty should not fall to the gas companies, but that a special company should be created and supported to deal exclusively with this matter.

THE AUTOMATON GAS LIGHTER (*J. G. L.*, May 3).

A new form of distance gas lighter. Its chief merit is claimed to be that the actual moving mechanism depends on clockwork, and the increase in gas pressure only "pulls the trigger." In many devices vibration plays a part, for there is present a variable amount of friction, which a slight vibration may decrease. Consequently the apparatus has been known to light up lamps at the wrong time, owing to a small transitory pressure rise below that really intended to extinguish or light up lamps. In the automaton arrangement, it is claimed, this possibility is reduced to a minimum.

GAS AT THE JAPAN-BRITISH EXHIBITION (*G. W.*, May 21).

HIGH PRESSURE GAS LIGHTING IN BIRMINGHAM (*J. G. L.*, May 24).

RENDERING ACETYLENE HEADLIGHTS EFFICACIOUS IN FOGS (*Acetylene*, May).

GAS BELEUCHTUNG; NEUE INVERTBRENNER BELEUCHTUNG MIT FLUSSIGEN LEUCHTMATERIALEN (*Z. f. B.*, April 30, May 10).

LES GRANDS INSTALLATIONS D'ACETYLENE EN AMERIQUE (*Rev. des Eclairages*, April 30, May 10).

L'ACETYLENE APPLIQUE AUX ILLUMINATION D'EGLISES (*Rev. des Eclairages*, May 30).

MISCELLANEOUS.

ELECTROMAGNETIC PHYSIOLOGICAL EFFECTS (*Electrician*, April 15, 1910).

Refers to an interesting direct physiological effect of magnetism discovered by Prof. S. P. Thompson and described at the meeting of the Royal Society on April 14th. When the head is inserted into a large solenoid actuated by an alternating magnetic field a curious flickering sensation, coupled with an impression of faint luminosity, is experienced. This is believed to be due to induced currents, which in some way stimulate the optic nerve.

Contractions used:
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World.
Illum. Eng. Lond. Illuminating Engineer (London).
J. G. L. Journal of Gaslighting.
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
Z. f. B. Zeitschrift für Beleuchtungswesen.

The Illuminating Engineer

Vol. V AUGUST, 1910 No. 6

RECREATION

The story is told of an old horse that worked six days of the week in a brick yard, its work consisting in walking around and around, hitched to the end of a lever which turned the pulverizing wheel, continuously in the same direction around a circle some eight yards in diameter. When its work was done it was taken to the stable to pass the night. It happened once upon a time that the old horse on a Sunday was turned out into the open pasture, and here is where it showed its "horse sense." It began to walk around and around in a circle, but IN THE OPPOSITE DIRECTION from that in which it walked during the week. This was rest and recreation.

We all need at more or less frequent intervals to get out of the small circle of our daily grind of duties, and loosen the tension of our nerves by going in exactly the opposite direction from that of our accustomed routine. Recreation is not mere idleness, not a simple standstill, but a period of RE-CREATION of our energies, our ambitions and our physical strength. Time spent to this end is the most profitably spent of all.

We are apt to get the idea that, without our constant presence, our own little business in particular and the world in general must come to a sudden stop. It is well to put ourselves entirely out of reach of our duties for a time, if for no other purpose than to realize that we are not an essential, but only an adventitious element in human affairs; that our necessity is only that of improving our own opportunities and abilities and securing our own happiness to the greatest extent possible.

Let us all set aside a period for recreation in its true and literal sense, and for that time forget light, illumination, and all other subjects that, for the majority of our waking hours, commonly engross our attention. So shall we bring a renewed energy and enthusiasm into our work later that will not only enable us to regain our lost ground, but that will carry us ahead with winning speed in the race to come.

E. L. Elliott.

FIG. I.—TYPICAL ERECTING SHOP.

Railroad Illuminating Engineering

V.—ERECTING SHOP LIGHTING.

BY HAROLD KIRSCHBERG.

With the rapid growth of illuminating engineering that has taken place in the last five years has appeared a realization on the part of lamp manufacturers of the importance of its application to the sale of their products. Illuminating engineering data of fair reliability is now obtainable from most manufacturers, while some of them furnish data from the best authorities. Assistance in the solution of illuminating problems is also tendered to those contemplating installations and the arguments advanced for the use of any particular lamp or accessory seldom fail to include a complete discussion of its advantages from the standpoint of the illuminating effects produced.

It is to be regretted, however, that many manufacturers and sales agents have not as yet located their particular fields of endeavor, and that in their laudable efforts to obtain business they suggest material which not only will not produce the best results, but in some instances is inapplicable, inefficient and expensive. Every lamp and lamp accessory on the market to-day, with few exceptions, is particularly and peculiarly applicable to some set of conditions; and the solution of many of our problems would be much more easily obtained, with satisfactory results to both seller and purchaser, if each source of light were limited to its own field. In addition, the disadvantages of

various sources of light would not be as apparent under such conditions as the advantages of the same sources in their correct fields of application. No one type of lamp will solve all lighting problems, and it would therefore seem advisable for a salesman to analyze a problem well before suggesting the use of his lamp for its solution.

It is perhaps due to conditions as set forth in the preceding paragraphs that the lighting of railroad shops is so variegated, and that its solution is still so much in doubt. So many shops are maintained by a railroad that the ideas of one shop foreman on the lighting question, gained by discussion with salesmen, usually differ by a wide range from those of any other shop foreman, whose ideas result from discussion with other salesmen. These foremen, having more or less complete control of their shops, usually decide to use the lamps presented by the best salesman, with the result that, while the lighting may be much better than the systems formerly in use, it is still not the best, which, by reason of the improvements, is still in doubt. The result is that we find on one of our large railroad systems erecting shops illuminated with everything in the form of lamps from incandescents to flaming arcs, passing on the way through A. C. and D. C. multiple and series, open and enclosed carbon arcs and Cooper-Hewitt lamps.

That the problem is capable of one best solution is not to be doubted; in fact, it may really be solved by the use of several different types of lamps, which fact merely illustrates one of the cases where the fields of some lamps may overlap. The solution, however, will vary somewhat with local conditions. Much has been written on the subject of shop lighting, but railroad shops are so diversified in the kind of work done that each kind of shop deserves individual consideration. The particular type under consideration in this article is what is known as an erecting shop.

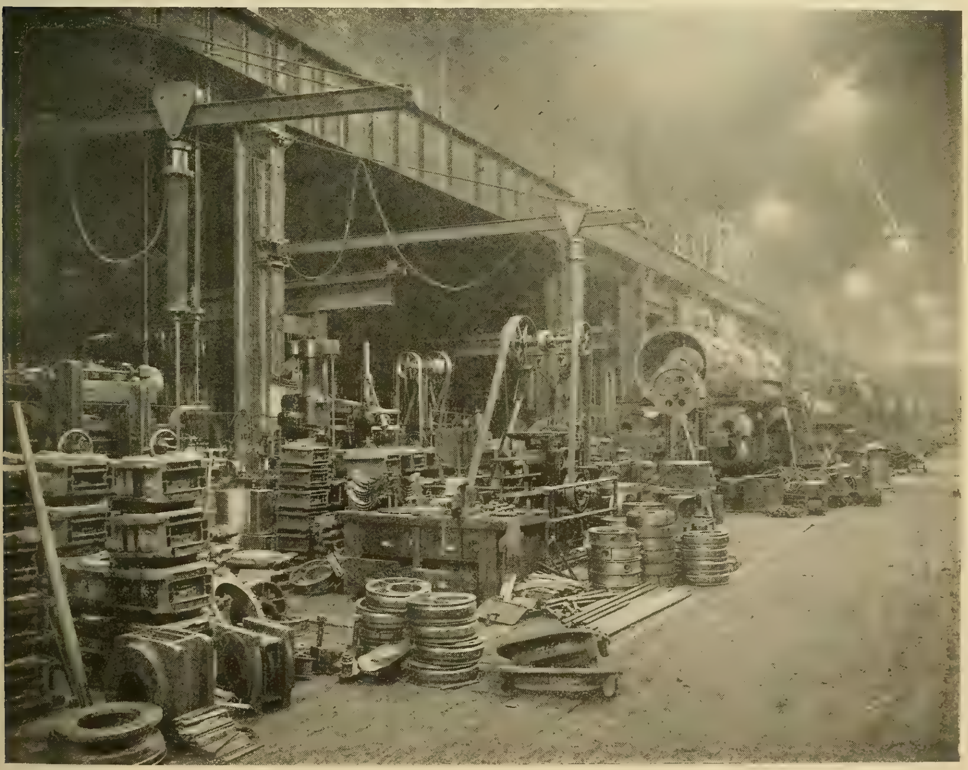


FIG. 2.—HEAVY MACHINE WORK SECTION OF SHOP.

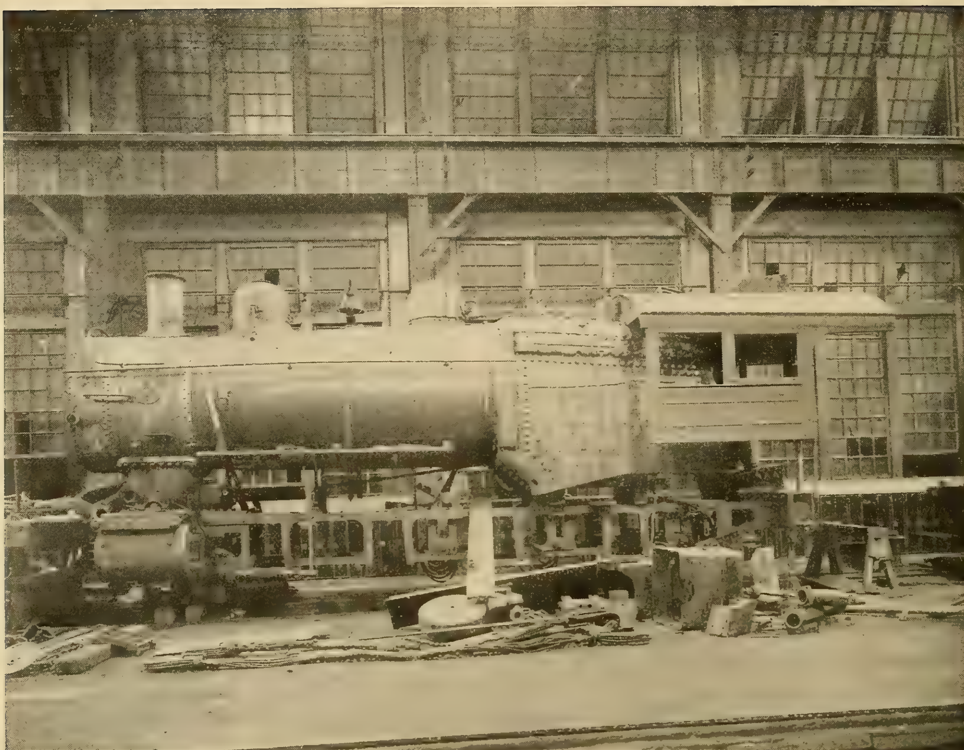


FIG. 3.—BOILER REPAIRS.

An erecting shop is used primarily for the repair of locomotives. Minor locomotive repairs are usually made in the engine house, repairs of greater magnitude being done in the erecting shop. Such repairs may be anything from replacing wheels to total dismantling of the locomotive. The various operations performed should be studied before attempting to satisfy the lighting conditions, for these operations sometimes require close work. An instance may be cited as that of facing a valve seat.

The building is usually rectangular in form, with concrete foundations and steel skeleton, about 80 ft. wide and anything up to 650 ft. in length. The roof is usually of the serrated type, or of the truss type, with truss chords about 40 ft. from the floor. About one-half of the roof is glass, the walls being at least three-quarters window space, in order to admit as much daylight as possible. The remainder of the interior is usually whitewashed, but becomes dirty and almost black in a short time. Very little reflection, therefore, from walls and roof is to be counted upon.

Immediately below the truss chords are the cranes, the number depending on the size of shop, but never being less than two. Three tracks and pits run the length of the building, one in the center and one about 15 ft. to center line from the side walls. A shop substantially the same as that described is shown in Fig. 1. In this shop the far end is used in the double capacity of a boiler and machine shop, so making the problem of lighting more difficult by the addition of a number of other conditions. A possible solution of the lighting for that end of the shop might be effected by either a different type of unit or a different spacing of units. A few illustrations of the class of work done in this shop are shown in Figs. 2 and 3. The desirability of good lighting with the production of no dense or sharp shadows is clearly apparent.

There are still other layouts of erect-

ing shops, the advantages and disadvantages of which have been the subject of much discussion in railroad circles. As instances we have the following, which tend to complicate the lighting problem still further:

First: The transverse shop, as differentiated from the type shown in Figs. 1, 2, 3, which is known as a longitudinal shop, has its tracks arranged across the building at right angles to its length, as shown in Fig. 4.

Second: The herringbone arrangement, with tracks at about 60 degrees to the long axis of the shop, is somewhat of a cross between the longitudinal and transverse arrangements. Such an arrangement is shown in Fig. 5. The type of lamps to be used and the locations of same are, therefore, dependent to some extent upon the type of shop to be illuminated.

Where a portion of the shop is used as a machine shop the illumination should be sufficient to enable one to distinguish fine details, such as scriber and punch marks and scale divisions. Throughout the shop light must be provided on both sides and both ends of a locomotive on any track, and on all portions of every machine in the shop. The use of many portables is to be discouraged by reason of the long runs of loose wire necessary and the danger incident thereto. An even illumination layout which does not produce the aforementioned effects will not be correct. Were the shop more open or less encumbered with machinery and tools, as is the case in a foundry, any even illumination scheme would do, provided it satisfied other conditions of intensity, color, etc. In this case, however, the distribution of light must also include a careful consideration of its direction. It is apparent that all units to be used for general illumination must be placed above the cranes, that is, at least 40 ft. high. The lamp accessories, to obtain best distribution results, should, therefore, be treated as an important part of the installation and should be kept in prime condition. No doubt, the color of the light used will assist or detract from the general physiological effect, depending upon the intensity of illumination desired, which intensity may be well placed at about 1 foot-candle.

The electrical conditions of alternating or direct current and voltage may impose

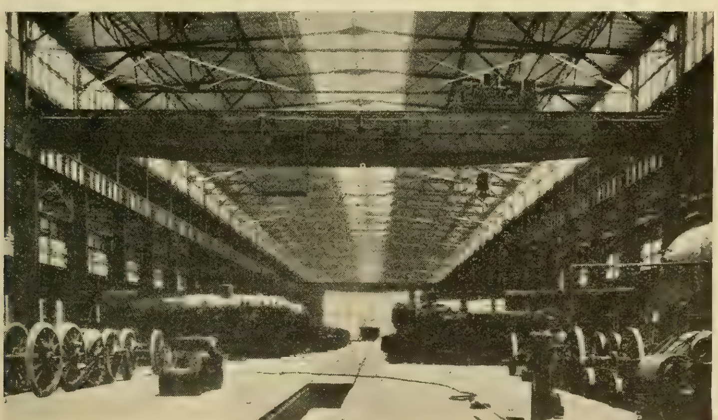


FIG. 4.—HERRINGBONE ARRANGEMENT OF SHOP.

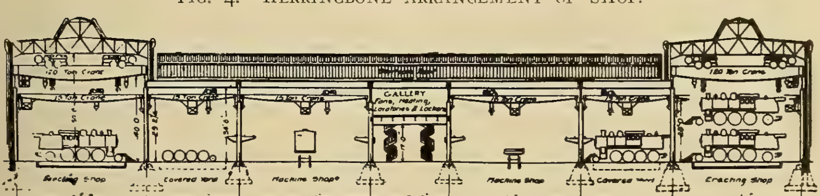


FIG. 5.—TRANSVERSE ARRANGEMENT.

further limitations in the choice of lamps. Where direct current is used, 220 volts is the usual standard in order to satisfy motor conditions for individual drive. Lamps will, therefore, be used in a series-multiple arrangement, and precautions must be taken to obviate the possibility of a failure of more than one lamp at a time. Straight series systems should not be used, this from the standpoints of both safety and economy of service. The general considerations of efficiency, cost of installation and maintenance, care required, reliability, steadiness, etc., are to be given their full weight in the final decision. No lamp, no matter how efficient, can be an economical proposition if all of the light produced is not used advantageously,

By reason of the disinclination generally shown to keep lamps and reflectors clean, a lamp to be used in erecting shop lighting should be one with a natural distribution of light requiring least reflecting accessories to obtain the desired distribution.

A number of very creditable installations have recently been made in erecting shops in various parts of the country, using in several of them entirely different types of lamps. The test of time will, where the illumination is good, be the deciding factor of their individual successes. This factor may be well expressed as total cost per foot-candle per hour per thousand square feet. Considering the fact that the best examples of erecting shop lighting are of very recent date, a decision regarding the best type of installation is still in abeyance awaiting the cost over an extended period of time. The possibilities of further improvements in lamps may present new methods of solving the problem, but, being still a problem peculiar to a railroad, it is particularly meet that railroads should give it due consideration as a portion of railroad illuminating engineering.

Some Problems in Railway Illuminating Engineering

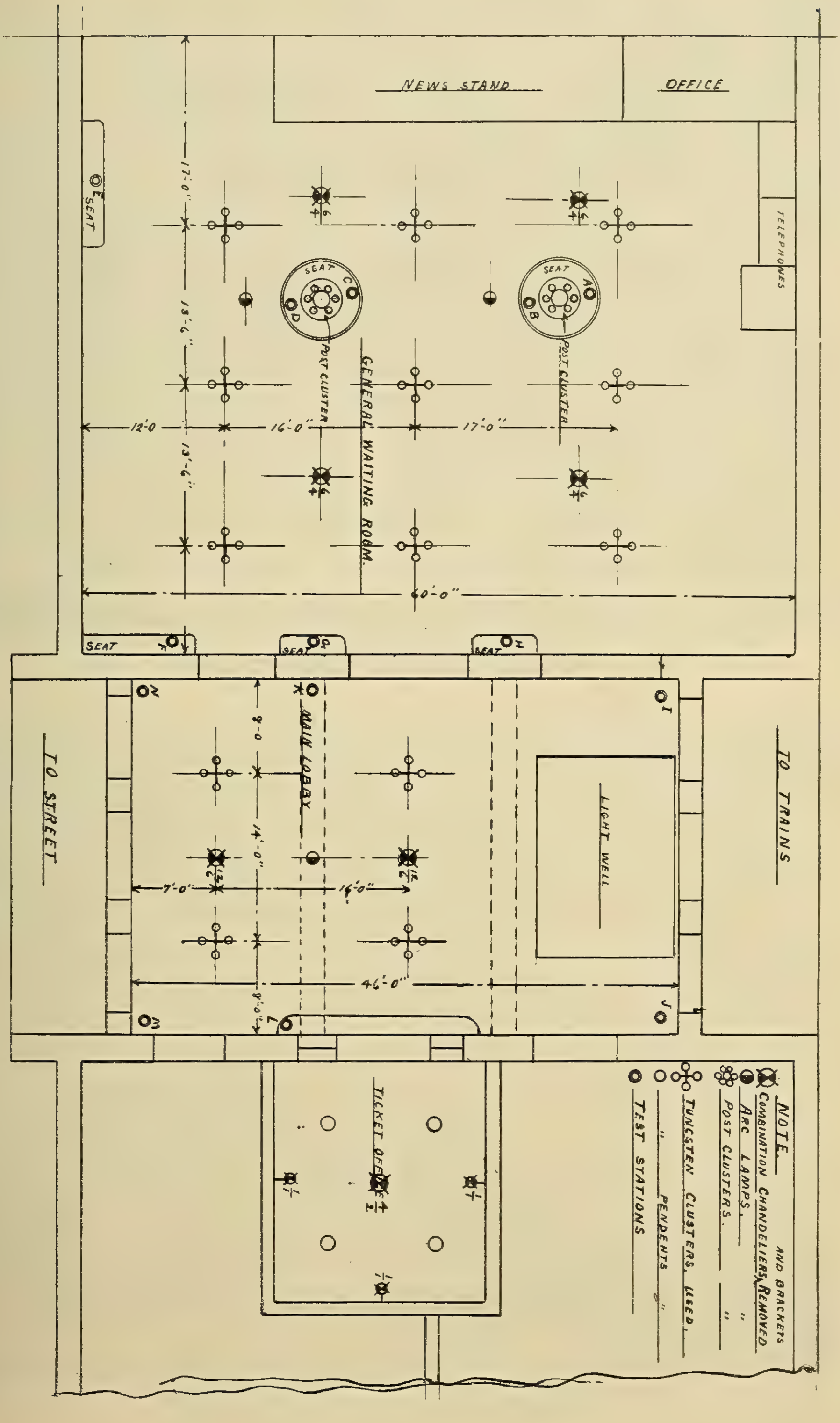
By Chandler R. Gilman.

About a year ago complaint came to me of the poor lighting of one of our freight offices. The room is 70 x 90 ft. and accommodates 90 clerks, doing freight office work, which, owing to the various colors of the freight bills and the fact that most of them are made out in pencil, requires good light. Previously each man in this room had one 16-cp., 220-volt, 64-watt lamp on a long cord, covered with a paper or tin cone shade. He placed the lamp wherever he pleased and the cobweb of cords hanging from the ceiling was not a thing of beauty, to say the least. The total watts used was 5760, watts per square foot, .91. While the wattage was not bad, the illumination and appearance were abominable.

I laid out the space in squares as near as possible and placed 52 60-watt, 110-volt tungsten bowl etched lamps, two in series, on the 220-volt wires. We placed over them large tin enameled shades and hung the lamps 5 ft. above the desks. Twelve-inch tin cone shades were used because we had them and did not think it best to throw them away and purchase more modern equipment, although the appearance would have been much improved. However, we now light the room very satisfactorily with 3120 watts, .5 watts per square foot.

We have had very good results with the tungsten lamp, getting an average of over 2000 hours life from them. Since then I have changed a number of small offices, and in each case we have saved about 50 per cent. on current, and have yet to receive a complaint after the change.

For work of this kind I find 5 ft. above the desk, with an extensive type of reflector, about right. The candle feet on the desks is from 3.4 to 4.1, but work of this character requires more light than one would judge to be necessary. This is largely on account of the personality of the men and the condition of their eyes. Although I have tried to show them that too much light will increase their eye



UNION STATION MILWAUKEE WIS.

FIG. I.

trouble, I find them very set in their notions regarding illumination, and am obliged to place the lamps lower than my judgment tells me they ought to be.

I am now changing the lighting in the lobby and general waiting rooms of our Union Station in Milwaukee. The old system was elaborate combination chandeliers hung 8 ft. above the floor. These had to be supplemented by three arc lamps (see Fig. 1). There were in these two rooms 60 220-volt, 16-cp., 64-watt carbon lamps and three 220-volt, 700-watt arc lamps, making a total of 5940 watts, watts per square foot, 1.18. We removed the chandeliers and arc lamps and replaced them with 13 four-light fixtures, as shown in Fig. 1. The lamps hang 14 ft. above the floor and are equipped with prismatic reflectors. Fifty-two 60-W. bowl etched, 110-volt (two in series) lamps are used, a total of 3120 watts.

General comparison:

Watts used before change	5,940
Watts used after change	3,120
Watts saved per hour	2,820

Illumination table:

Test before change was made. Stations.	C. F.	Test after change was made. Stations.	C. F.
"A"	1.5	"A"	2.20
"B"	2.0	"B"	2.30
"C"	1.75	"C"	3.00
"D"	3.00	"D"	2.40
"E"	0.70	"E"	1.50
"F"	0.70	"F"	1.70
"G"	0.50	"G"	1.80
"H"	0.50	"H"	1.80
"I"	0.10	"I"	1.20
"J"	0.10	"J"	1.10
"K"	2.00	"K"	2.20
"L"	2.20	"L"	2.30
"M"	1.70	"M"	2.00
"N"	1.70	"N"	2.00

Average c. f. before change	1.32
Average c. f. after change	1.96
Watts per sq. ft. before change was made	1.18
Watts per sq. ft. after change was made	0.62
Saving per year at 2½ cents per 1,000 watts, average lighting 10 hours per day	$267.32

The Illumination of the Patten Gymnasium of the Northwestern University

By A. D. Curtis.

The new gymnasium presented to the Northwestern University by Mr. James A. Patten, and erected at a cost of approximately $200,000, is one of the first large buildings of the kind to have had the advantages of careful illuminating engineering in the layout of its lighting installation.

An exterior view of the building is shown below. The two principal rooms are the track room and the gymnasium; the former is 129 x 193 ft. inside dimensions. It is covered with a truss roof, as shown in Fig. 2, the center of which is 50 ft. high. Besides its use for indoor sports, it is also intended for occasional use as an auditorium.

The gymnasium room is shown in Fig. 3. In lighting large rooms of this description heretofore, it has been the com-

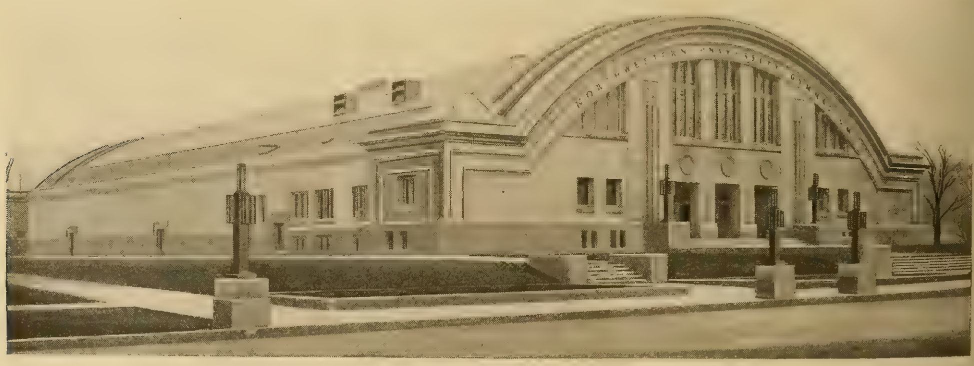


FIG. 1.—THE PATTEN GYMNASIUM, NORTHWESTERN UNIVERSITY, EVANSTON, ILL.

FIG. 2.—INDOOR TRACK AND BALL FIELD. NOTE BOX-LIKE ARRANGEMENT OF FIXTURES.

FIG. 3.—GYMNASIUM.

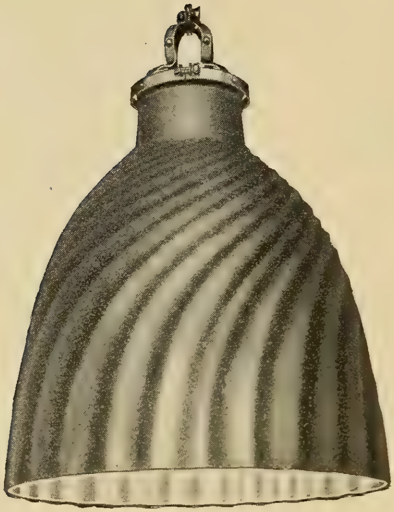


FIG. 4.—TYPE OF REFLECTOR DESIGNED SPECIALLY FOR THIS INSTALLATION.

mon practice to use arc lamps, either in clusters or singly, and equipped with some kind of diffusing globe. The illuminating engineer in charge in this case was averse to the use of any units which would leave the light-source, even though modified by a diffusing globe, in the line of vision of those using the room. As the ceiling did not permit of the use of a complete indirect lighting system, it was decided to use a combination of direct and indirect lighting, the indirect being used chiefly to take off any appearance of gloom that would arise from a dark ceiling. In order to hide the light-sources a special reflector and fixture was designed. The form of the reflector is shown in Fig. 4. It is of spiral corrugated crystal glass, silver plated on the outside.

The distribution curve is shown in Fig. 5.

Each of these reflectors contains a 100-watt tungsten lamp. The fixtures consist of square iron cases, open at the bottom, and attached directly to the structure supporting the ceiling arches. In the top of these cases, which was somewhat extended, were placed 25-watt tungsten lamps for the ceiling lighting. The general arrangement of the fixtures is well shown in the illustrations. The cases were given a lantern-like appearance, and harmonize well with the simple and massive architectural construction. The illumination is secured at an expenditure of .9 watt per square foot, with an estimated illumination on the floor of 3 ft.-candles.

The results have proven entirely satisfactory to the University authorities, as well as to those using the rooms, and is a good example of the solution of a difficult problem in modern lighting by illuminating engineering.

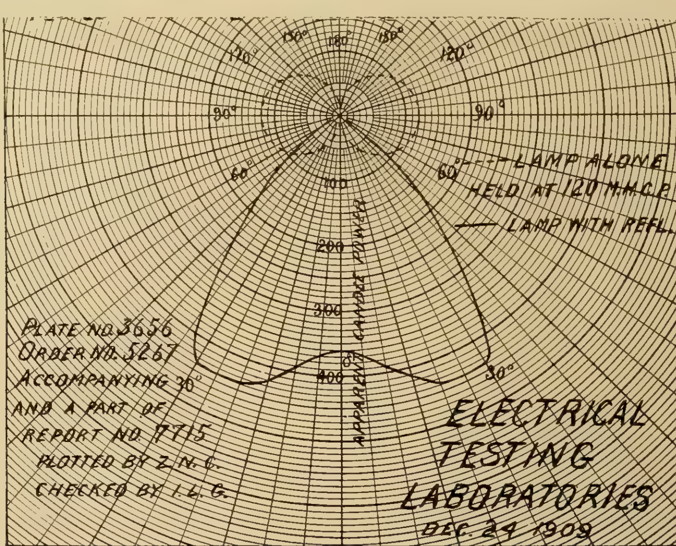


FIG. 5.—TYPICAL CURVE, SHOWING DISTRIBUTION OF LIGHT FROM 150-WATT CLEAR BULB TUNGSTEN LAMP AND SPECIAL REFLECTOR, ILLUSTRATED IN FIG. 4.

The Flame Lamp as a Street Illuminant

By A. J. Mitchell.

An aggressive spirit of improvement, demanding better street illumination, has been active throughout the length and breadth of this country for the past few years, which is steadily growing with added vigor every day.

This sentiment is nurtured by that same immutable law of our sociological estate, which avers that a specific demand for improved methods, or the conception of radical innovations, in any line of human endeavor is invariably met by the production of the desired commodity in the one case and a prompt appreciation of its values in the other. Economical considerations are invariably the chief desideratum that impels the inventor to exhaustive efforts in the betterment of existing conditions or the production of new devices.

The flaming arc is a tangible response to that call from the apostles of progressive economy. Its perfection is a most creditable achievement on the part of our present day genii and a "shining" example of the triumphs of man's fertile brain.

Its economic superiority, or more correctly efficiency, when compared with other types of illuminants, electric or otherwise, has been fully exploited by various writers on the subject, and the figures are no doubt familiar to most readers of this article.

There is another phase, however, that enters largely into the successful adaptation of flame lamps for street lighting besides the mere question of candles per watt, if we consider the subject without limitations as to the kind of current available for their operation.

The problem is an easy one, from a commercial standpoint, when using this type of lamp only for lighting the business sections of large cities, where multiple circuits (usually direct current) are the available source of electrical supply; but to insure the adoption of these lamps in the smaller though equally progressive cities of our republic the production of a series flame lamp, that would not only operate with perfect satisfaction on a constant current circuit but in conjunction with the ordinary carbon lamps of the series type, became a necessity.

The regenerative flame lamp has been developed for this class of service and is, we believe, the first flaming lamp to enjoy such a distinction. The success of the tungsten lamp in street lighting has been due to its ready adaptability to series currents at low unit voltage and a wide range of current values, but it falls short of meeting the popular demand for a unit of high light intensity when spectacular or imposing illumination is desired. The regenerative flame lamp enjoys a combination of three distinct advantages, when considered from the standpoint of suitability for street lighting, the first of which is a fairly long life of carbons, averaging about 70 hours; a good distribution of the light, as shown by the photometric curve in Fig. 2, and, thirdly, the ability to operate at any standard current adjustment

FIG. 1.—STREET ILLUMINATION, WITH REGENERATIVE FLAME LAMPS.

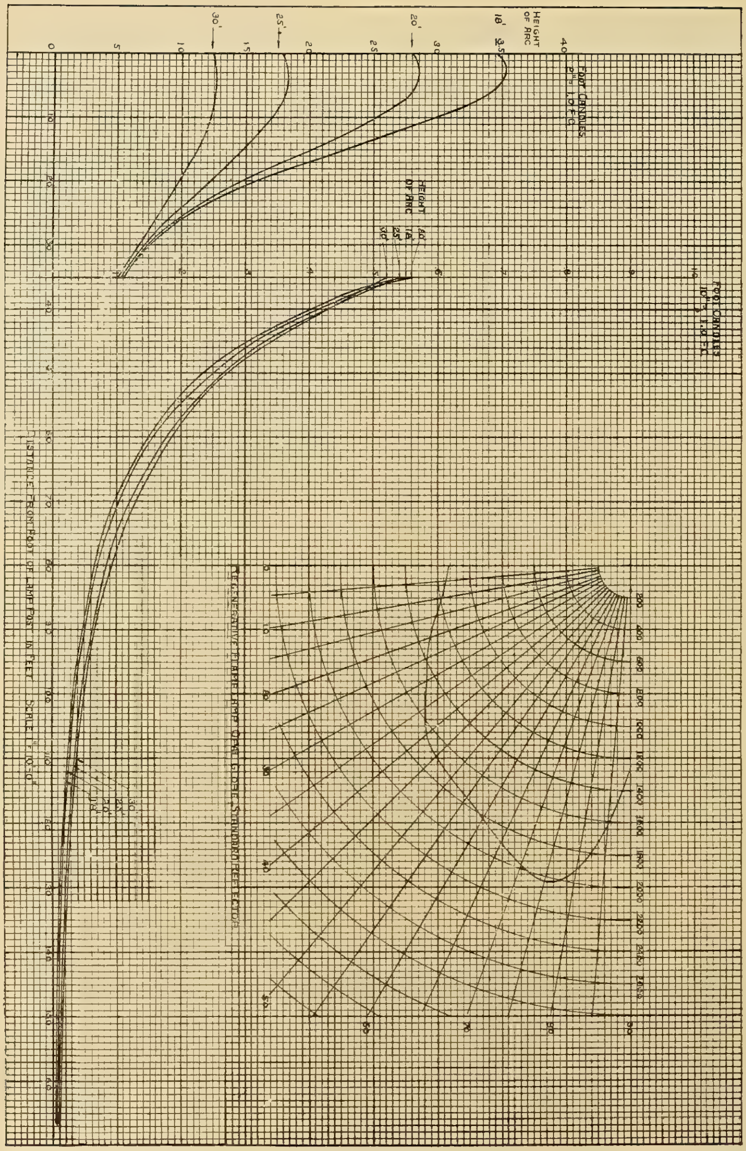


FIG. 2.—PHOTOMETRIC DISTRIBUTION OF THE FLAME LAMP.

without the interposition of an auto-transformer or reactance coil to boost the current and lower the voltage, with the losses attendant to the use of same.

It is pretty generally conceded that well lighted business thoroughfares have become a commercial necessity, and this fact is fully recognized in up-to-date communities, as the recent efforts put forth in various cities to virtually annihilate darkness will attest. People love light, the crowd follows the glare, and that street is always best patronized where it is most in evidence.

There is a fascination about a well lighted street that no one can quite explain, but we all enjoy. It is akin to the pleasurable sensation of daylight to the nerves.

One mistake usually made in attempt-

ing these effects with ordinary carbon or tungsten lamps is in suspending too near the ground and thereby bringing the light source too nearly on a line with the eyes of pedestrians a short distance away, and thereby causing more or less visual discomfort. While this arrangement of these lamps is more or less essential to secure the best distribution on the sidewalk or ground, owing to the low intensity per unit, and sometimes serves as a plausible reason for using columns or poles of extremely artistic design, but of about the same height as the archaic gas lamp posts of bygone days, although the ratio of light from the two sources, and to which the eye must accommodate itself, is at least ten to one. The flame lamp with its vastly higher candle-power can and should be hung from twenty-five to thirty feet above the ground, depending somewhat on the distance apart, and with its characteristic orange ray produces a soft, agreeable light that is penetrating and yet not dazzling or tiresome to the eye.

The relative cost of operating a flame system as compared to tungstens or carbon arcs is rather hard to compute without knowing the requirements of each particular installation, as the question of even illumination is often made subservient to a regard for the spacing of lamps that will bring the location of each just where extreme light is desired.

Suffice it to say that in a comparison of foot-candles per square foot of surface illumined the cost of producing same is obviously in favor of the flame lamp with its ratio of 0.24 of a watt per hemispherical candle-power, compared to a value of 1.25 at best for tungstens or carbon arcs and about 0.6 for the magnetite. The question of carbon cost, which has heretofore perhaps militated somewhat against their more rapid adoption, is now a much less formidable one, thanks to recent revisions in the price of regenerative flame carbons, so that the present carbon cost for lamps of this type, based on current prices of 30 cents per pair, is less than ½ cent per hour per lamp, and if we include the labor cost for trimming, estimating same at 5 cents per trim, with an average of sixty trims per year, makes the total cost for carbons and trimming $21 per year per lamp. The ordinary carbon arc operating under parallel conditions would require an expenditure of $3.56, taking labor cost at the same figure and carbon cost at 3 cents per trim, while a cluster of 5-100 watt tungstens, consuming 500 watts and producing a horizontal illumination of 400 candle-power, would cost for renewals not less than $20 a year per cluster. A comparison of these costs per foot-candle, produced by the different types of lamps based on the mean spherical candle-power, gives .013 cent for the regenerative and .0095 cent for the carbon arc and .056 for the tungsten cluster, or a ratio of nearly five to one in favor of the flame lamp as compared with the tungsten, and about five times the illumination, with practically the same consumption of current.

The magnetite or luminous arc is proving a very efficient and satisfactory method of lighting streets, but the mistake is invariably made of hanging these lamps too near the ground and of using clear globes instead of opalescent ones and thereby softening the sharpness of the light.

The operating cost of these lamps is low when compared with the volume of light produced, and an ideal and highly efficient combination of lighting units for street illumination, in the writer's opinion, would be the adoption of the series regenerative flame lamp for the business section and most thickly populated portion of the city and the luminous arc for the strictly residential districts, current for both systems being supplied from the same machines, but necessarily on different circuits, as the magnetite, by reason of the nature of its electrodes, operates only on direct current; but the conversion from the A. C. supply is easily effected by the usual method of utilizing mercury rectifiers in connection with the station regulating apparatus for the respective circuits.

FIG. I.—VIEW SHOWING THE ARRANGEMENT OF THE SIGN.

The Largest Electrical Sign in the World

The first issue of THE ILLUMINATING ENGINEER contained a descriptive article under this same title, the "Butterick" sign being then the largest. "The Leaders of the World" display sign, which has recently been put into operation on top of the Normandie Hotel, Thirty-eighth street and Broadway, is not only the largest electrical sign of any description, but in elaborateness of detail, as well as in mere dimensions, completely overtops anything that has previously been attempted. An idea of the size and complexity of the structure can be got from the view shown in Fig. 2. The superstructure on top of the hotel is equivalent to an entire building, several stories high.

It is impossible to give any adequate idea of the sign as it appears in action, for the double reason that the whole scene is in colors, and flashing to represent rapid motion. A part of the flashing takes place at the rate of 2500 flashes per minute. The general scheme, however, is shown in Fig. 1. The lower part of the sign depicts the famous Chariot Race, and the effect of moving wheels and racing horses is brought out with marvelous realism. Above this is the signboard, upon which appear the various advertisers under the caption, "Leaders of the World."

Fig. 3 shows a portion of the sign, the size of which may be judged by the relative size of the workmen. The sign contains nearly 20,000 electric lamps, requiring 600 hp. to operate. Over ninety-five miles of electric wire were used in making the connections. The sign faces Herald Square, one of the most crowded points in greater New York, and at pres-

ent is the most conspicuous attraction among all of the numerous electrical signs and displays which have made the "Great White Way" famous throughout the world.

The continued growth both in the expensiveness of individual signs, and in the number of signs displayed, is convincing evidence of their advertising value. Compared to other forms of advertising it is probable that the electric sign costs more for each individual that sees it than does advertising in popular periodicals. A page display in the *Saturday Evening Post* is said to cost $3500 for one issue, and its reputed circulation is something more than one and a half millions. It is safe to add somewhat to this for additional readers beside the original buyer.

It would be interesting to make an estimate of the pedestrians who nightly view the signs along New York's "Great White Way," figure the cost of the sign, and compare it with printers' ink advertising. Whether the cost per person seeing it is more or less, one thing is certain: IT PAYS, or advertisers would not continue to increase their expenditures for this kind of publicity as they are so rapidly doing.

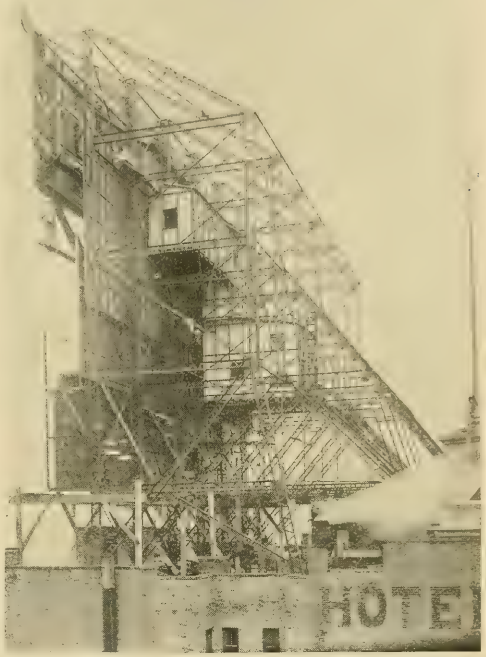


FIG. 2.—FRAMEWORK FOR SUPPORTING THE SIGN.

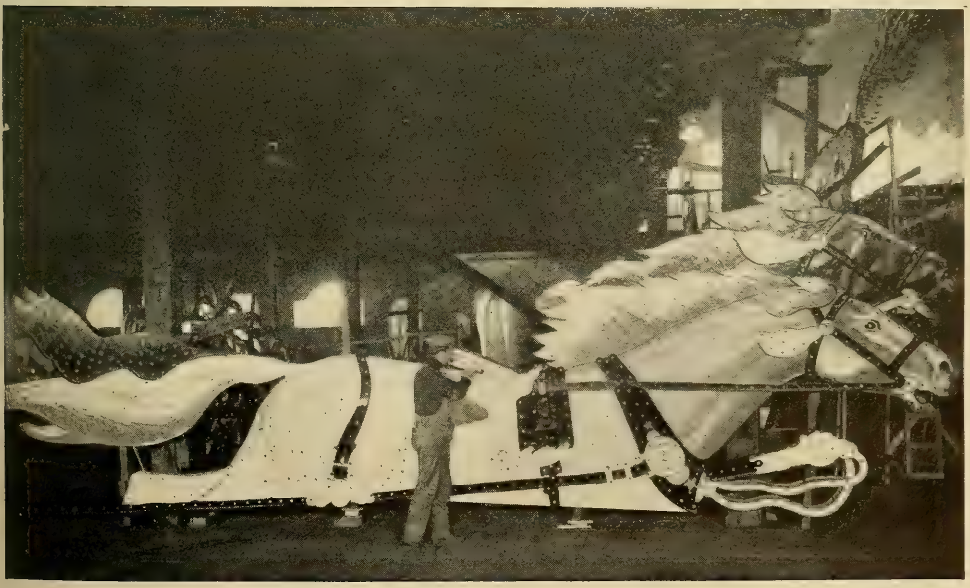


FIG. 3.—THE HORSES USED IN CHARIOT—SHOWING REATIVE SIZE.

A Test of Three Different Methods of Lighting a Railroad Machine and Erecting Shop

By George W. Walker.

The problem in this case was a typical modern machine and erecting shop, the building being 572 ft. long and 310 ft. 6 in. wide, and divided lengthwise into five aisles. One of these aisles was divided into three sections, which were lighted by Nernst, Cooper Hewitt and tungsten lamps, respectively. The ground plan, showing the arrangement of these aisles and of the different lighting systems installed is shown in Fig. 1.

The method of making the illuminometer readings is as follows:

A test section was taken in the center of each group of lamps, and in this section twenty stations were located, as shown in the diagram, at which the illuminometer readings were made. In comparing the results it should be noted that the section in which the tests of the Cooper Hewitt lamp was made was subjected to errors due to shadows caused by two large slotting machines. At station 13 in this section, the light of the lamp directly overhead was practically cut off by one of these machines. Stations 17, 18 and 19 had each the direct light of four lamps cut off, and station 20 that of five lamps. Stations 17, 18, 19 and 20, under the Nernst lamp group, were also slightly shadowed by a radial drill.

Readings at the different stations in the three different test sections are shown in Table II.

A summary of the various data contained is shown in Table I.

Eleven Cooper Hewitt lamps had been in service about two years, during which time three tubes had been renewed. The Nernst and tungsten lamps had been in service three weeks, burning approximately 10 hours a day, six days per week. Ten of the twelve lamps were equipped with clear globes and two with opalescent globes; all were equipped with opalescent enameled reflectors. The 250-watt tungsten lamps all had clear bulbs and were equipped with focusing type prismatic re-

Table No. I.

Class of work: Large machine tools.
Dimensions of aisle: 65 x 572 ft. Area: 37,180 sq. ft.
Number of bays, 26; each 22 ft. wide.

	Cooper Hewitt Lamps, Type P.	Nernst Lamps, 3-Glower.	Tungsten Lamps, 250-Watt.
Height to center of trusses	37 ft. 6 in.	37 ft. 6 in.	37 ft. 6 in.
Height of lamps	36 ft.	36 ft.	36 ft.
Height of test plane	2 ft. 6 in.	2 ft. 6 in.	2 ft. 6 in.
Height of lamps above test plane	33 ft. 6 in.	33 ft. 6 in.	33 ft. 6 in.
Number of lamps	11	12	12
Square feet illuminated per group	15,730	12,870	8,580
Number of lamps per bay	1	1½	2
Square feet illuminated per bay	1,430	1,430	1,430
Average voltage	113	237	115
Average current amperes per lamp	3.5	1.75	2.07
Average watts per lamp	395	415	238
Average square feet per lamp	1,430	1,073	715
Average watts per bay	395	622	476
No. test stations per group	20	20	20
Watts per square foot	.276	.387	.333
Square feet per watt	3.62	2.59	3.00
Average foot candles	1.20	.928	.896
Foot candles per watt per square foot	4.35	2.40	2.69
Lumens	18,876	11,943	7,688
Lumens per watt	4.35	2.4	2.7
Watts per lumen	.23	.42	.37

flectors. As the Nernst and tungsten installations have only been in three weeks it is impossible at present to compare the maintenance costs.

TABLE NO. II.

Foot Candle Readings of 60 Stations, 20 to Each Group of Lamps.

Test Stations.	Cooper-Hewitt, Type P.	Nernst Lamps, 3-Glower.	Tungsten Lamps, 250-Watt.
1	1.5	1.22	1.2
2	1.55	1.23	1.2
3	1.58	1.28	1.2
4	1.60	1.25	1.21
5	1.41	1.13	1.05
6	1.64	1.1	1.14
7	1.50	1.14	1.08
8	1.58	1.15	.94
9	1.40	.96	.83
10	1.11	.97	.92
11	1.43	.93	.99
12	1.15	.91	.98
13	.82	.73	.835
14	1.00	.70	.79
15	.97	.71	.76
16	1.14	.74	.71
17	.70	.62	.49
18	.67	.62	.505
19	.68	.59	.53
20	.565	.58	.57
Average....	1.20	.928	.896

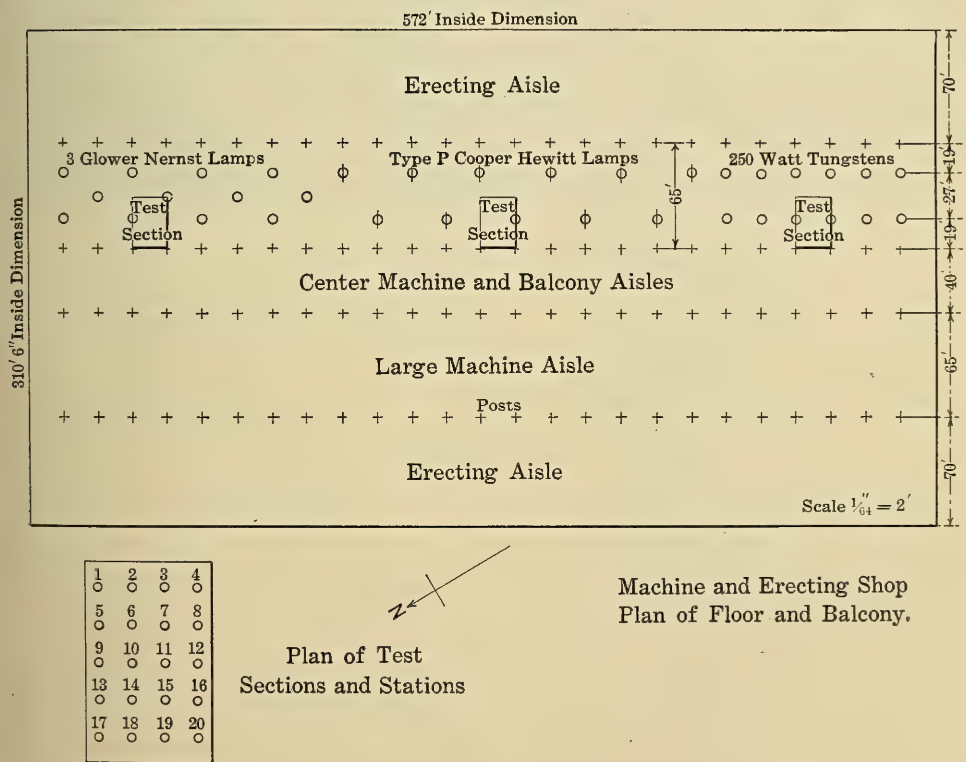


FIG. I.—PLAN SHOWING LOCATION OF UNITS AND TEST STATIONS.

FIG. I.—NIGHT VIEW, GRANT PARK, CHICAGO, ILLUMINATED WITH EIGHTY FLAME ARC LAMPS.

Military Maneuvers by Electric Light

The illumination of a baseball field by artificial light so as to permit night games was successfully accomplished a year ago, and at the time was a record feat in outdoor illumination. A new record of this kind of lighting has recently been established in Grant Park, Chicago, where an open space sufficiently large for a military tournament has been successfully illuminated so that maneuvers could be given for public exhibition at night.

The arena measured 400 by 600 ft., and the lighting installation consisted of 80 flaming arc lamps placed at a height of 35 ft. above the ground, arranged in ten rows of eight lamps each. The lamps were suspended from cables having a clear span of 600 ft., thus leaving the way clear underneath. As a lamp may be safely rated at 3000 candle-power, there was a total of 240,000 candle-power developed. The illumination was ample to show every feature of the maneuvers, and was uniform over the space covered. The tournament provided an exceptional attraction, being opened on the Fourth of July as a part of the "Sane Fourth" movement, and was witnessed by as many as 60,000 spectators on a number of occasions.

This is undoubtedly the most extensive artificial lighting installation for such a purpose that has ever been put to practical account. The fact that it was entirely successful in its purpose, and added materially to the attractiveness of the maneuvers, in that it permitted not only two performances daily, but enabled many to attend who would have been unable to take day time for the pur-

pose, suggests great possibilities for similar illumination in the future. Novelty in itself is a very large element in spectacular amusements, and the mere fact that sports, which we have always been accustomed to think of as possible only by day, can be equally well carried on by night lends an additional interest.

The expressions, "making a street as light as day," or "turning night into day," are stock phrases of the newspaper reporter, but they come nearer and nearer to expressing an absolute truth. Modern light sources have made it possible to conduct every occupation as well by night as by day. A question of night or day work is now one merely of expediency on the part of worker or employer.

Transportation of both freight and passengers, by land and sea, goes on quite as safely and efficiently whether the sun is above or below the horizon.

Now that we have turned light to the practical account of doubling the hours of labor, it is no more than fair we should turn about and make it double the hours of recreation. This is already done so far as indoor amusements and pleasures are concerned, and we are now well into the beginning of the era of more extended opportunities for out-of-door recreation made possible by the same means.

Besides giving the illumination by which various amusements and sports can be carried on, light itself offers almost endless means of furnishing spectacles and amusements in itself.

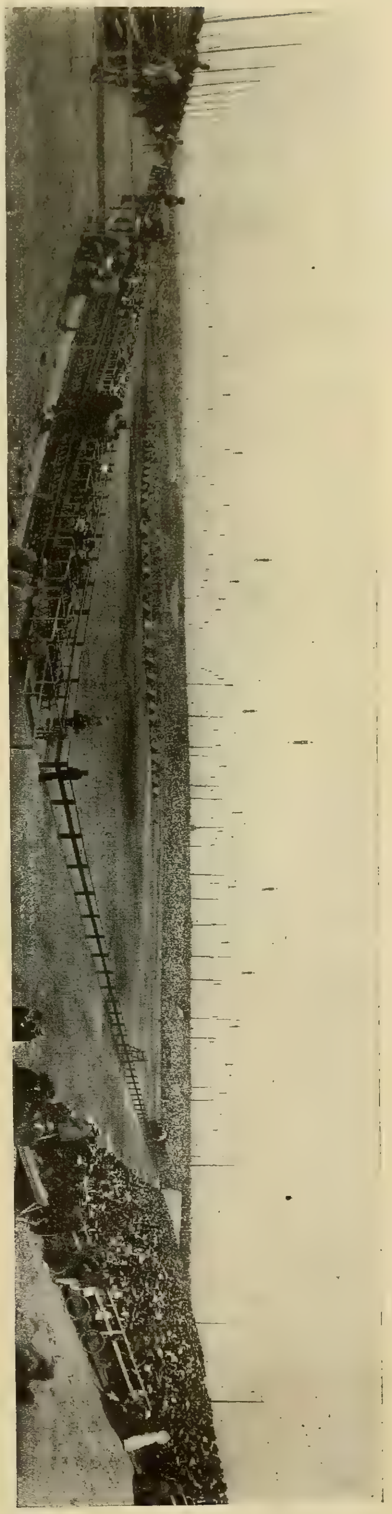
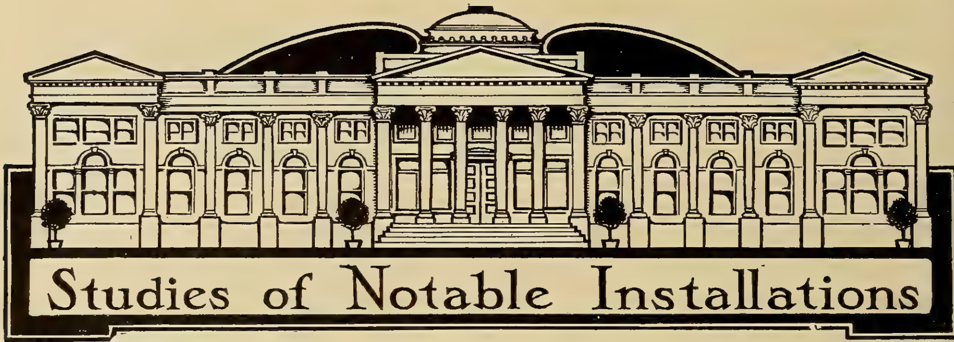


FIG. 2.—PANORAMA VIEW OF GRANT PARK, CHICAGO.



The Illumination of the Electric Building, Portland, Oregon

By W. M. Hamilton.

The Electric Building was built and is owned by the Portland Railway, Light & Power Company, a corporation which owns and operates the principal electric street railways and electric current supply systems in Portland and the adjacent territory.

The company occupies all of the basement and the first, second, third, fourth and fifth floors, the remaining four floors being occupied by tenants, such as doctors, lawyers, architects, contracting and engineering firms, manufacturers' agents, etc.; all of the professional men being among the leading men in their profession in Portland, and the engineering and commercial firms being among the largest of their class. They thus constitute a very high grade of tenants, and, although the rate of rent for offices in the building is the very highest in Portland, almost every office was engaged before the building was completed. This demand for offices in the Electric Building was largely due to the fact that prospective tenants were promised that the illumination of the building would be of the very best, and the tenants have since expressed themselves as being of the opinion that the promise has been well fulfilled. The exterior illumination of the building also helped to create a demand for offices, for the building stands out like a beacon at night, and as a result almost every one in the city knows where the "Electric" Building is situated. This feature of having the location of the building so well known is, of course, a valuable asset from a tenant's standpoint.

The question of the illumination came up first when the plans of the building were being drawn, and it was decided in view of the fact that the electric light company was the owner of the building that the illumination would have to be featured. On the other hand, the building was being erected as a commercial enterprise, and the management had stipulated that the cost of construction and operation must not be excessive. Therefore, in laying out the wiring plans the capacity allowed was between one and one-half and two watts per square foot of floor area to be illuminated. This is the average allowance in all first-class office buildings, as those who are familiar with the subject are aware.

At first it was thought that 250-watt tungsten lamps and prismatic or opal reflectors would be used on short fixtures, with one lamp to the outlet. Therefore, the majority of the outlets were wired for a capacity of 250 watts per outlet. This resulted in most cases in there being two outlets to a circuit, same having an actual capacity of 330 watts per outlet.

Indirect illumination was suggested for some of the rooms, including the board of directors' and the president's offices, the assembly hall, etc. The writer suggested the use of the indirect lighting system and submitted photos and cuts illustrat-

FIG. I.—NIGHT VIEW OF THE ELECTRIC BUILDING, PORTLAND, ORE.

ing same, but the management had never seen an installation of that kind and was not favorably impressed with the idea. Plans were, therefore, drawn and estimates made for a system of cove lighting, in which the lamps were to be concealed in coves which were to be run entirely around the rooms, the light from the lamps to be thrown against the ceiling and then down into the room.

This system, as is well known, is quite expensive to install and very expensive to operate, due to the large amount of current required to give a sufficient intensity of illumination on desks and tables.

Just before the above mentioned plans and estimates were completed the president and the general superintendent of the light and power department of the company made a trip East, and while in Chicago saw a few installations of indirect illumination, and were so well pleased with the illumination produced that they decided to install the system throughout the *entire* building.

Therefore, a set of plans of the building was sent to the manufacturers of this system of illumination, with a request that they submit specifications of the equipment that should be used to give the best results. Their recommendations were

adopted with a few exceptions, the principal of which was in the design of the fixtures. They recommended a fixture with a straight stem and arms. The straight arms made the fixtures appear top-heavy to the writer, and he, therefore, suggested that the arms have the double curve drop shown in the accompanying cuts, in order to give a sense of balance.

Two three-light fixtures are used in most of the larger private offices and one three-light in the medium size offices, and one two or one-light in the smaller offices. The total number of fixtures used is as follows:

92 one-light.
63 two-light.
279 three-light.
2 four-light.

The recommendations of the manufacturers called for about two-thirds of the lamps in the offices to be 100-watt tungsten lamps, whereas 60-watt lamps were installed throughout to start with. So far it has only been found necessary to replace a few of the 60-watt lamps with 100-watt, although more of them may be changed later.

When the indirect system of illumination was decided upon, attention was turned to the tinting of the walls and ceilings. The walls were tinted a light tan color and the ceiling a *very* light ivory. Inasmuch as the walls of a room are almost constantly in the range of vision, it is not advisable, of course, to have them tinted white, or even nearly so, as the strong light that would be reflected from a white wall is very trying on the eyes. On the other hand, they should not be too dark, for then the *contrast* between the walls and the bright ceiling would be hard on the eyes.

The ceilings were tinted ivory instead of pure white, to relieve them of the harsh, cold appearance that is possessed by a dead white ceiling.

Although a very high degree of diffusion is obtained in the electric building,

FIG. 2.—A SECTION OF THE OFFICES OF THE PORTLAND RAILWAY, LIGHT & POWER COMPANY.

FIG. 3.—ENGINEERING DEPARTMENT.

sufficient shadows are cast by the various objects to remove the "flat" appearance that exists in rooms where cove lighting is in use. About the same amount of shadow is cast by the artificial light as is cast by average daylight. Such shadows are very desirable, for they aid greatly in determining the character of the surface of an object.

One peculiar feature of this kind of illumination that is noticed by almost every one is that when one enters a room and looks about the illumination seems very moderate and may appear almost dim at times, but upon looking down at a paper on a desk or in the hand you are very much surprised to note how bright the paper is and how easily you can read what is written or printed thereon.

This is caused by the fact that all light sources are out of the range of vision, and, therefore, the pupil of the eye is allowed to expand freely and adjust itself to the intensity of light reflected from the paper, thus permitting the maximum amount or flux of light reflected from the object to enter the eyeball. The absence of the customary exposed light sources is what causes the room to *seem* dim. One of the most important advantages of the system is that there is but little or no regular reflection or glare from highly polished surfaces, such as glazed paper, etc. It is this glare that exists, where direct lighting is in use, that is so very injurious to the eyes. A person *can* protect one's eyes from the exposed light sources by use of eyeshades on the desk lamps, but it is almost impossible to avoid the glare from highly polished surfaces that are bound to come within the range of vision. This glare can be avoided to a certain extent, of course, by holding the paper or book at which one is looking in the proper position with relation to the light sources, but it is not practical or even possible to do this in many instances when the arrangement of the furniture in

the room is arbitrary, or when there are several light sources in the room.

It is the consensus of opinion among those who have been in the building after dark that the illumination is very excellent and far superior to the old system of direct lighting. One great advantage is that no individual lamps are required.

People often inquire if the intensity of the light is not very soon reduced by the dust that settles on the lamps and reflectors. Of course, any indirect method of illumination requires more labor to keep the lamps and reflectors properly cleaned than is required by a direct lighting method. However, that is a small item when the superior results of the indirect system are considered, for, if the reflectors and lamps are dusted twice a month, there will be no trouble on that score. When one stops to consider that the furniture and other fixtures in the offices are dusted at least 26 times a month, it does not seem to be asking too

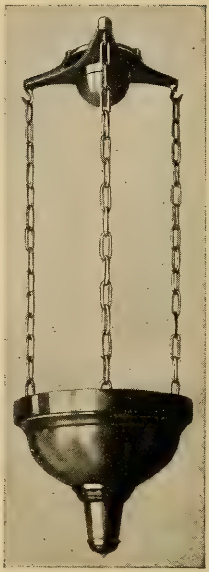


FIG. 4.—A TYPE OF SINGLE LIGHT UNIT USED.

FIG. 5.—A SECTION OF ONE OF THE PRIVATE OFFICES.

FIG. 6.—TYPE OF FIXTURE FOR TWO, THREE AND FOUR LIGHT UNITS.

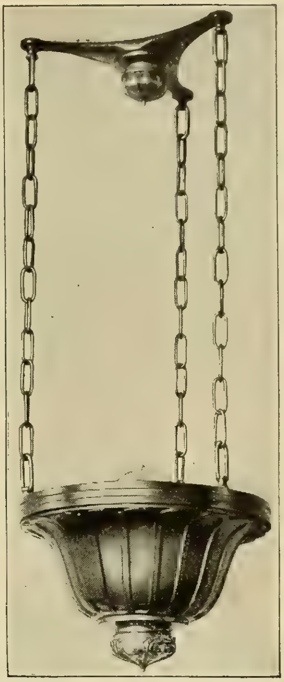


FIG. 7.—ANOTHER TYPE OF SINGLE LIGHT UNIT USED IN PRIVATE OFFICES.

much to expect that the lighting fixtures be dusted two times a month.

Most people believe that an excessive quantity of current is required to operate all indirect lighting systems, but by comparing the data of the installation in the electric building given below with similar data of many direct lighting installations such will not be found to be the case. The reason why this belief exists is because of the well known fact that the old form of cove lighting *does* require a very large amount of current to develop sufficient illumination; and inasmuch as the latter is the only method of indirect lighting that is known of to any extent by the general public they very naturally assume that *any* indirect system of illumination requires an excessive amount of current.

As a matter of fact less current is required for this system of indirect lighting than is required by the old cove lighting, in which the lamps are concealed in coves around the walls of the room. This is due to the fact that powerful reflectors are used to throw the light against the ceiling, and the light is then reflected directly down upon the tables and desks, whereas in the cove lighting system the light from the lamps strikes the ceiling at such an angle as to reflect off onto the side walls rather than down upon the desks and tables. By the time the light from a lamp finally reaches the desks after having been reflected back and forth several times it has decreased greatly in intensity, and therefore the total candle power of the lamps must be very high to make up for this loss in reflection and produce the proper intensity on the working plane.

Then, too, the use of tungsten lamps helps to reduce the amount of current required. It is interesting to note that the amount of current being used in the electric building per square foot of floor area is less than that being used by many of the company's own customers in their premises, where direct lighting systems are in use.

The writer does not believe that a correct idea of the effect of this method of indirect illumination can be conveyed to a person by means of worded descriptions

or photographs. For that reason he would suggest to anyone interested in artificial illumination that they avail themselves of the first opportunity to visit an installation and make a personal examination of the results produced.

SCHEDULE OF INSTALLATION IN VARIOUS TYPICAL AND SPECIAL OFFICES.

Occupant of office.	Number of fixtures.	Lamps per fixture.	*Watts per fixture.	Total Watts.	Size of room. All ceilings 10 ft. high.	Area of floor.	Watts per sq. ft.
Pres. Josselyn, P. R. L. & P. Co.	4	1	100	400	19 x 19	361	1.11
Vice-Pres. Fuller, P. R. L. & P. Co.	2	3	180	360	14 x 20½	280	1.25
Gen. Supt. Coldwell, P. R. L. & P. Co.	2	3	180	360	16 x 18½	296	1.21
Store & Cont. Dept., P. R. L. & P. Co.	22	3	180	3,960	21 x 52 32 x 23	1,828	2.17
Display room, P. R. L. & P. Co.	6	3	180	1,080	38½ x 19	731	1.47
Assembly room, P. R. L. & P. Co.	8	3	180	1,440	18 x 47	846	1.70
Drafting room, P. R. L. & P. Co.	8	3	270	2,160	18 x 47	846	2.55
Accounting Dept., P. R. L. & P. Co.	29	3	180	5.220	66 x 38 20 x 22 54 x 16½	3,840	1.36
Mgr. Cransten, G. E. Co.	4	2	120	480	19 x 19	361	1.33
Dr. Bruere's corner reception room	4	2	120	480	19 x 19	361	1.33
Middle reception room	2	3	180	360	19 x 17	323	1.11
Private office	2	3	180	360	19 x 14½	275	1.31

* This wattage per fixture is an *average* of the 100-watt and 60-watt lamps used in this room.

An Effective City Slogan Sign

THE BRISTOL CITY SLOGAN.

The city of Bristol has the unusual distinction of belonging to two States, Tennessee and Virginia, and if the citizens follow the example set by the Bristol Gas & Electric Company, it will attract attention to the inhabitants from both of these States. The company has recently presented the city with a fine electric sign, the arrangement of which is shown in the accompanying illustration. The sign is 60 ft. long by 30 ft. high, and contains 700 white, 100 red and 100 green lamps, or a total of 900, and was erected at a cost of $1200. It was designed by Mr. George Williams, and presented to the city by Henry L. Doherty & Co. In the operation of the sign the word Bristol remains stationary, the star scintillates, the arrows flash, followed by the words "Va., Tenn.," the word "Push" then spells itself out, followed by the flashing of "That's Bristol."

The sign was formally presented and lighted on the night of July 4, the Mayors of the twin city accepting the sign and officially turning on the current. It occupies a most advantageous position facing the railroad. It can be seen by every one passing through the city and for miles around the surrounding country.

FIG. I.—ROOM IN THE GERMAN EMBASSY, WASHINGTON, D. C.

Some Interesting Examples

A lighting installation may be notable for various reasons; its noteworthiness does not necessarily depend upon its size nor its prominence, a single lamp, or even a single fixture may be well worth study, either on account of its novelty, or as an example of good or bad illuminating engineering practice.

In Fig. 1 is shown a room in the German Embassy, Washington, in which there is a collection of unusual lighting fixtures, all constructed of silver. The central chandelier is a most unique piece, and is perhaps the extreme limit of the lavish use of metal as compared with the lamps which it supports. It must be looked upon rather as an exhibition of the silversmith's art than as a serious lighting fixture. The candle brackets shown on the walls of the room are evidently considered as curios rather than as lighting apparatus. They suggest, however, great possibilities for the design of electric or gas brackets in which the supporting plate would serve as a reflector as well as a decorative piece.

Fig. 2 is the music room of a California millionaire's residence. The lighting installation in here is notable for its extreme simplicity. The lamps placed at the intersections of the panels in the ceiling could scarcely be less decorative. The brackets used are equally simple in design. It will be observed, however, that the decorations of the room are equally simple, but that the effect as a whole is extremely good.

Fig. 3 shows the breakfast room in the same residence. Simplicity is equally manifest here. The furnishing is distinct-

FIG. 2.—MUSIC ROOM IN A CALIFORNIA MILLIONAIRE'S RESIDENCE.

FIG. 3.—BREAKFAST ROOM IN SAME HOUSE SHOWN ABOVE.

FIG. 4.—INTERIOR OF THE OFFICE OF THE SUPERINTENDENT OF THE CAPITOL, WASHINGTON, D. C.

ly Mission, and the chandelier, which, by the way, is combination gas and electric, is a fine example of wood construction in lighting fixtures, the possibilities of which have been but little utilized thus far. That it will serve the purpose and harmonize admirably with its surroundings in this case, there is not the slightest doubt.

Fig. 4 is the interior of the office of the Superintendent of the Capitol at Washington. Many of the lighting installations in the Government buildings have been previously criticized in these pages. To what extent the Superintendent is directly responsible for the lighting we are unable to say, but from the installation used in his own office, it is evident that modern illuminating engineering practice is as yet an unknown quantity with him. The lighting here is both inadequate and faulty. Bare lamps are used in such positions as to shine directly into the eyes of those in the room except when the superintendent's back is turned at his desk. His desk lighting consists of a single lamp and reflector hung over the middle of the desk, which cannot fail to give annoying direct reflections from the writing table. The lighting here is an example of the total lack of modern methods that are so often encountered in the equipment of the departments of the United States Government.

Fixtures and Accessories

Illuminating Glassware: Its Relation to Lighting Fixtures

CHAPTER I.

BY E. LEAVENWORTH ELLIOTT.

A lighting fixture in its simplest form is a mechanical device for supplying an illuminant at a point or points where it is desired to use that illuminant for producing light. To this end the only necessary material is metal. Except in cases where extreme economy must be practiced, or where the use of the illumination is for strictly commercial purposes, modern illumination demands some sort of shield or covering for the light-source for the purpose of either diffusing or directing the rays, or both. The material having by far the widest range of use for this purpose is glass, for the reason that it can be made either completely transparent, or of any degree of translucency down to complete opacity, and can be also used either to transmit or reflect light, or to do both within certain limits. Illuminating glassware therefore becomes a matter of importance in the construction of lighting fixtures second only to the metal and mechanical parts themselves.

In considering the relation of glassware to fixtures we may first observe that it has three fairly distinct uses, viz., first, as an essential part of the apparatus for producing the light, as in the case of a chimney for an oil or gas lamp; second, for diffusing and distributing the light rays; and third, as a decoration. It is, of course, evident that a single article may fulfill all three of these purposes.

The most conspicuous, and by far the largest class of illuminating glassware which is wholly utilitarian in its purpose, is the oil lamp chimney. This is as essential a part of the burner as the wick, and its shape and size are made with reference to securing the proper draught for obtaining the most luminous flame. On account of the necessity of frequent cleaning, it is rarely either frosted for diffusing the light, or etched for decoration, an additional globe being required for these purposes. The leading manufacturer of lamp chimneys, whose name has become a household word, is responsible for bringing this class of glassware to a standard, and of educating the public to the fact that lamp chimneys are not all alike, and that something more is necessary in their selection than the mere fitting of the holder. Although forming an important item in illuminating glassware from the commercial standpoint, the lamp chimney has practically no connection with fixture design or illuminating engineering, and may, therefore, be dismissed.

The incandescent gas lamp likewise requires a glass chimney or globe for its practical operation. In the early days of this form of light efficiency was the only object sought, and the straight, narrow, tall glass cylinder was exclusively used, diffusion and decorative effects being secured by accessory globes, as in the case of oil lamps. The demand for a burner with a single piece of glassware which should serve all three purposes, however, soon gave rise to the smaller but somewhat less efficient burner, and a variety of etched and decorated chimneys of globular or other ornamental form. Later, the discovery of the "air-hole" chimney enabled a much higher efficiency to be obtained, while still retaining the more dec-

orative forms. This improvement marked the final stage in the development of the upright incandescent gas burner.

The advent of the inverted burner brought about a new opportunity for the construction of globes which could combine all three properties. One of the chief advantages claimed for the inverted burner was its more artistic appearance. It is true that in the form first presented to the public it was provided with glassware which gave it a far more decorative effect than the original straight-chimney, upright mantle burner. As compared with the most improved form of upright burner, however, the inverted possesses no advantages in artistic treatment. A comparison of the examples given in Fig. 1 is convincing proof of this statement.

We come now to the consideration of illuminating glassware as an apparatus for diffusing and distributing light. The means of accomplishing these purposes are of three general kinds: First, roughening the surface of clear glass, usually by sand blasting or etching; second, rendering the glass translucent by the admixture of certain substances in the "metal" or body of the glass; and third, by forming one or both surfaces of the glass into corrugations or projections.

This property of diffusion is one which has been but vaguely treated and understood. The word is often even used ambiguously where distribution is meant.

A perfect diffusing surface is one which gives out light in all directions of equal intensity from every point.

Diffusing surfaces may be either reflecting or transmitting. In either case the nearest approach to theoretical perfection is reached with roughened opal glass. No method of comparing the diffusing properties of glass or other material have ever been suggested, so far as we know, and yet there is every degree of variation between faintly opalesced glass, which gives scarcely perceptible diffusion, and dense opal, which gives practically perfect diffusion. The diffusive power of glass would be accurately measured by giving the ratio of the lightest and darkest points on the surface, in the case of transmitting glass; and the ratio between the direct and diffused reflection of reflecting glass. This ratio would properly form a *Coefficient of Diffusion*, and would be susceptible of reasonably accurate and simple measurement. Thus a transmitting glass which showed equal illumination over the entire surface would have a coefficient of unity, or 100 per cent., while a globe which showed a minimum intensity of one-quarter the maximum would have a coefficient of diffusion of .25, or 25 per cent., and so on. The coefficient of absorption, and the coefficient of diffusion together would then accurately and completely measure the value of any given glass as a diffuser.

The coefficients of diffusion and absorption affect the design of lighting fixtures from both the engineering and artistic standpoints. The neglect of the simple and obvious precaution to allow for the absorption of the glassware has completely spoiled the purpose for which many a chandelier has been designed. In considering a lighting fixture from the engineering standpoint, it is, of course, necessary to consider the light *units* which it supports rather than the light-*sources*, *i. e.*, the light-source plus its glassware. The general conditions are summed up in two problems: (1) Given a certain intensity of illumination to be produced, and a certain kind of glassware, to determine the candle-power of the light-source required, and (2) given a certain illumination and a light-source of certain candle-power, to determine the coefficients of diffusion and absorption permissible in the glassware. These two cases cover all possible problems; on the other hand, there is no instance in which one or the other of these problems does not appear.

Whatever may be his opinions as to the value of illuminating engineering, or the importance of the artistic side of his business, the fixture manufacturer cannot despise the practical illuminating results. If these are unsatisfactory or disappointing the fixture can never be considered a success; the neglect of this practical side of the question may very readily destroy the effect of design and workmanship, which in itself is highly meritorious. No amount of architectural embellishment or magnificence can atone for methods of construction which prevent the building serving its practical purpose, and the same principle applies to fixture design.

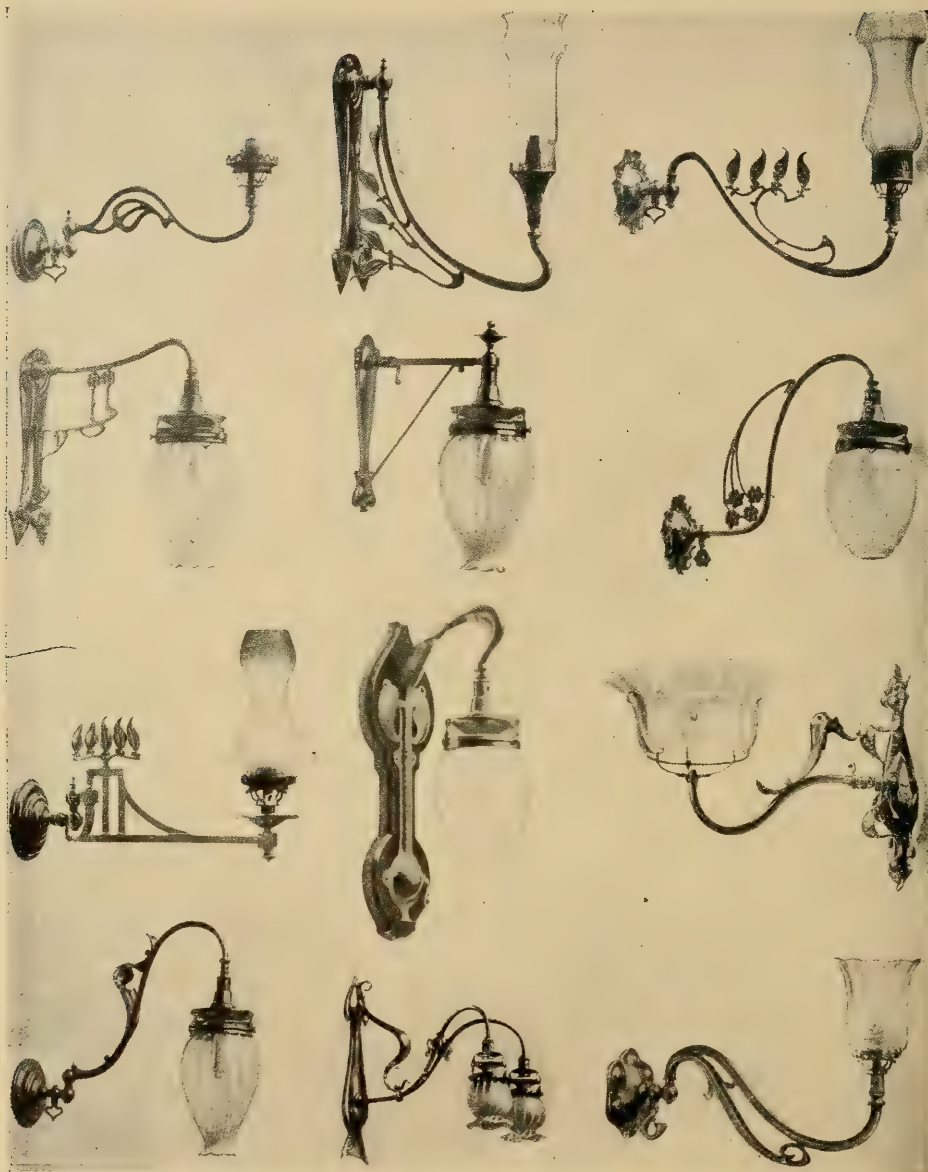
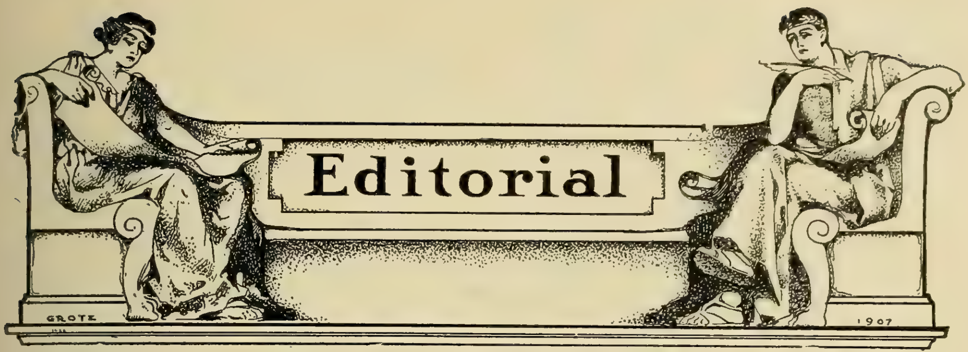


FIG. I.

From the purely decorative side of the question the diffusing properties of illuminating glassware are of great importance. Thus, a globe with a sufficiently low coefficient of diffusion to show plainly the form of the radiant may appear of different shape when in use than when seen by daylight. A common example of this is a spherical globe of lightly frosted or opalescent glass with the radiant placed near the top or bottom, causing the globe to lose its symmetry, and to present an entirely different aspect with reference to the fixture than it does by daylight. Long, stalactite-shaped globes with the radiant at the top is another example of similar distortion. Where globes of sufficiently low diffusion to show the radiant are used, care should be taken that the radiant is in the center of the globe.



Railway Illuminating Engineering

An Important but Neglected Field.

But a few years ago, the older professions were asking, " What is illuminating engineering? " and were generally skeptical as to the sufficiency of the subject to constitute a separate branch of science. To-day, illuminating engineering is not only a recognized branch of applied science, but is already subdivided into special fields.

Among the most important of these subdivisions is railway illuminating engineering. This properly forms a subdivision of the general subject for the reason that it involves a large number of peculiar problems, the successful solution of which demands all the special study and investigation which can well be expected of a single individual. Our readers have been given an idea of some of these special problems and conditions in the series of articles contributed by Mr. Harold Kirschberg.

The importance of the subject is one which invests it with peculiar interest to the public at large, as well as the professional illuminating engineer. After light there is probably no other public utility which so immediately concerns every inhabitant of the country as transportation, and anything that pertains to this utility therefore concerns the general public and the individual citizen.

Railway traffic may be clearly divided into two classes: Passenger and freight. Both of these classes are vitally concerned with the subject of artificial illumination. The two problems which most concern the public in the case of passenger traffic are the illumination of the passenger coaches and the railway stations.

Railway Car Lighting.

A modern American railway passenger coach in its highest development represents the very acme of luxury; the Pullman car is designed and built absolutely regardless of expense. For all this there are few cases of illumination that are more glaringly at fault; the average lighting of railway coaches is an atrocity. The faults, moreover, do not arise from the limitations imposed by the construction and use of the car itself, but from a neglect to observe the fundamental principles of illuminating engineering. Sit down in either a sleeper or day coach by night, and, turn as you will, there is a collection of dazzling light-sources in the very worst possible position to produce glare. In sleeping cars this glare is doubled or tripled by reflection from the highly polished surfaces of the upper berths. The small special berth lights that have been recently provided are useful if only one is occupying the section, but when both are lighted, both occupants have the glare of the lights directly in their eyes.

A large amount of study and expense has been expended in perfecting the means of supplying electric light for railway coaches, but the results have generally been to increase rather than to diminish the faults of the *illumination*. So far

as the comfort of the passengers is concerned, what is wanted is a study of the methods of producing an illumination that will be the easiest on the eyes while affording a sufficient intensity to enable one to read ordinary newspaper print without eye strain. There is no particular virtue in a light produced electrically; what the public want is illumination. There has been too much time and money expended in providing electric light for its advertising value, and too little in securing a comfortable and satisfactory illumination for the passengers.

Railway stations, as a general rule, are poorly and inadequately lighted, both within and without. While attention has been given to the illuminating engineering problems of station lighting in some of the more recent structures in the larger cities, the lighting of the majority of stations is still the result of hit-and-miss installations. The terminal station of one of the railroads supplying New York, which was completed only a few years ago, is so poorly lighted in the train sheds that a passenger or official cannot read a ticket without the aid of a lantern. Many a ticket seller is obliged to work with a bare incandescent lamp in front of his eyes. Railroads should see the importance of promoting a feeling of cheerfulness and good feeling in their passengers, and surely there is nothing more opposed to this than a dingy, gloomy, half-lighted station.

Hotels, theaters and business houses have found it a good investment to put up modern decorative lighting systems on the streets fronting their premises. Railways should at once follow this example in the case of their stations. The more progressive railroads are systematically improving the grounds, even about their way stations, by landscape gardening. Let them enhance the value of this work a hundred fold by the installation of suitable outdoor lighting.

Where proper exterior and interior station lighting is not furnished, the local civic associations should take up the case and use their persuasive powers upon the railway officials. A handsome, brilliantly lighted station is one of the most important of all things in giving a first and lasting impression of thrift and hospitality to a city. In one of the thriving cities of Ohio its most enterprising private citizen built a railway station at his own expense in order to make a good impression upon visitors and those passing through the town, as well as to afford comforts and facilities for his fellow townsmen.

Passenger traffic is naturally carried on more by daylight than at night, thus necessitating the handling of freight more largely at night. Among the special illuminating engineering problems connected with freight traffic, as pointed out by Mr. Kirschberg, the lighting of freight classification yards is perhaps the one demanding most attention at the present time, since it may be considered as yet an unsolved problem, no reasonably satisfactory method having been devised. It is a problem which demands the co-operation of the illuminating engineer with the construction and electrical engineers. As freight can be moved no faster than it can be classified and made up into trains, and as this is done largely by artificial light, the importance of the problem is apparent.

The question of railway signals depending upon artificial light is a special subject in itself, and owing to its especially vital importance has been given considerable study, but there is still room for more.

The importance of good illumination for clerical use has been often dwelt upon, largely on humanitarian grounds. The necessity for providing the best of light for different kinds of work has likewise been urged for economical reasons.

The lighting of erecting shops and roundhouses is another problem of high commercial importance.

In this field of illuminating engineering, as in some others, the West has taken the lead. A convention of Railway Illuminating Engineers was held some three years ago in Chicago, and a club made up with a similar membership has maintained a flourishing existence since.

Notwithstanding all of these vitally important illuminating engineering problems we are not aware that a single railroad has an officially recognized illuminating engineer. It is time that this anomalous condition of affairs should be

reformed. Every railroad should have an illuminating engineer who should have final authority in all matters pertaining to artificial lighting, and be responsible directly to the general manager of the road. Illumination is not a side issue nor a sub-department, but is a subject of primary and distinct importance. The economies which could be secured by such a course would make the maintenance of a department of illuminating engineering a most highly profitable investment.

A general survey of the present practice of lighting in connection with railways undoubtedly leads to the same general conclusion, and there is no gainsaying the fact that there is no great enterprise in this country to-day that stands so badly in need of the services of competent and specially trained illuminating engineers as the railways.

The Education of Lighting Company Employees

Carnegie aroused considerable discussion several years ago by publicly proclaiming his doubt as to the value of the regular college course to the young man who contemplated a business career. The fact that he had never had such advantages himself, and that, from the commercial standpoint, his own career had not been wholly devoid of success, was an example which was left to be inferred. As to the value of direct training and education for practical work of life, however, the canny Scot had no objections to offer.

The race of commercially successful ignoramuses is happily becoming more nearly extinct, and the habit of sneering at "book larnin'" and "eddication" much less noticeable. The self-made man will probably always continue to worship his maker; but he is performing his worship more in accordance with the scriptural injunction "secretly in his closet."

There is no well authenticated case on record where real knowledge has injured a man. "A little knowledge is a dangerous thing," but it is the littleness, and not the knowledge, that constitutes the danger.

It has been frequently said that the best thing about a college course is to show the recipient how little he knows; and, while the statement is a rhetorical exaggeration, it contains a foundation of truth. There is no case so absolutely hopeless as the confirmed "know-it-all." Acknowledged ignorance may be readily forgiven, and in time removed; but the one who has nothing more to learn has no further mission in this world, and ought to be translated to some other sphere.

The employees of lighting companies are, on the whole, a set of ambitious, energetic, hardworking and intelligent men. Many of them have not had the advantages of technical or college training, and many of them also owe all of their practical and technical knowledge of the production and distribution of gas or electricity to their daily work with their company. Furthermore, they are young men who have yet the best years of life and work before them. To increase their knowledge of the business is to increase their value to their company, and, therefore, to themselves.

It is a mistake to suppose that they need to know only what concerns their particular department, or routine. Every single detail of the business, whether commercial, technical, scientific or political, is knowledge of positive value, and the more any given employee has of it the better for himself and his employer.

Some of the larger central stations, notably the New York Edison Company, have taken this matter of education of their employees in hand, and afforded them excellent opportunities for acquiring a full knowledge of the subject. We are obliged to admit that, in respect to the education of its employees, the gas interests have not been equal to the central stations.

An excellent movement is now on foot to furnish technical and other instruction to the employees of gas companies through the medium of the American Gas Institute. The Institute could not possibly undertake a more valuable and laudable purpose. The one danger to all associations of this kind is of settling down into a state of "innocuous desuetude"—of eventually succumbing to dry rot. Perfunctory scientific papers which appeal to one out of a hundred, and drag their weary way through the columns of the

trade papers until they finally disappear like a ship at sea; meetings and conventions which are carried out with due pomp in the presence of empty benches, and handsomely bound "proceedings," which are well nigh ancient history by the time they appear, have some value, or at any rate are supposed to have, but it is mighty little as compared with the living, active and effective work which can be accomplished through organization by *constant personal efforts to assist those who most need assistance and in precisely the manner in which they most need it.*

The American Gas Institute has an opportunity to accomplish a very great work along this line for the gas interests, and it is exceedingly pleasing for us to witness its efforts in this direction. The National Commercial Gas Association is also working to the same general end, and we again take occasion to respectfully submit that these two separate organizations should combine, and thereby more than double their strength.

Be this as it may, let each continue in the good work of educating the gas company employees to a higher condition of general knowledge, to greater enthusiasm and to loftier ideals; and, reciprocally, let the employees seize the opportunity thus afforded them for bettering their condition by joining one or both of these associations.

The Illusive Curve

There is a popular superstition that figures and photographs do not lie, and, while the peculiar form of expression known as the "curve" has never been categorically included in this superstition, it has been tacitly assumed that, from its very nature, it must be the embodiment of absolute truth. The fact is, however, that the curve is just as illusive and quite as subject to dexterous manipulation as the photograph or the table of statistics.

The reader has doubtless seen the effect of the photographic distortion known as "foreshortening," brought out in a grotesque manner, as in showing a person with a foot as large as the rest of the body. The same principle less obviously displayed will make a 10 x 20-ft. interior look like a spacious hall, or a building on a single city lot stretch back into the distance the apparent length of a block. An analogous case with the curve is that of the familiar distribution curve of a light-source equipped with a concentrating reflector. In comparison with the bare lamp such curves give to the uninitiated the idea of a vastly greater amount of light. We have commented on this at various times before, but repetition will do no harm in view of the commonness of the fact. Again, it is almost impossible, even for those perfectly familiar with this method of expression, to compare the values of two curves drawn to a different scale.

A more subtle misrepresentation of curves recently came to our attention in the case of their use to show the distribution of light upon a street pavement. The curves in this case represent "isolux lines," *i. e.,* the location of points that were equally illuminated. The purpose of such curves, of course, is to show the evenness or unevenness of the distribution. In this particular case the one showing decidedly the most even illumination did not visibly disclose the fact that the illumination was everywhere inferior in intensity to that of the comparative case in which the distribution was far less uniform. In another case a curve was used to represent an unusual comparison with a decidedly misleading effect.

The curve, of course, is a very useful, in fact well nigh indispensable, method of representing values; but it must not be accepted without a very careful scrutiny of just what it is intended to represent, and of the method used in its drawing. The layman will do well to submit his conclusions to some one thoroughly familiar with this peculiar language of mathematics before taking important action on knowledge gained from "curves."

Decorative Outdoor Lighting With Gas

Of the many recent installations of decorative outdoor and street lighting, how many has gas to its credit? With the exception of two or three minor cases, we do not recall a single installation. What are the reasons for this conspicuous absence of gas lighting in this coun-

try? It is well known that in the race for mere brilliancy gas lighting has won with high pressure lamps in Berlin and other European cities, and that it fully holds its own in competition with the newest forms of electric lamps. Is the failure of gas to even enter the race in this country another case of the gas interests allowing themselves to be outflanked and out-marched by their competitors, or are there some real commercial or technical reasons for the existing status of decorative gas lighting? From the best information which we have been able to obtain, it would appear that the inverted multiple burner gas lamp, or "gas arc," has been brought to a state of practical perfection, such that gas companies can now enter the lists in the contest for spectacular lighting without handicap.

The Illuminating Engineer has always maintained that there is room for all the different illuminants, and that the more vigorously each is pushed by its own promoters the better it will be for all interests. If modern gas lamps are now available for decorative and spectacular illumination, and such appears to be the case, we should like to see the gas interests avail themselves of the opportunity to promote gas lighting in particular, and better illumination in general, by going after this class of business.

"An open field, a free hand to all, and may the best man win."

National Electrical Contractors' Association Convention

This convention was held on the Million Dollar Pier, Atlantic City, July 20-22. While the gathering was by no means a failure, the question arises whether Atlantic City at its height furnishes just the right "atmosphere" for the serious work of such conventions. The boardwalk is not a place that inspires to meditation and analytical thought. The lure of the beach is often more persuasive than the rap of the chairman's gavel. It is asking a little too much of human nature to turn a mere man loose at Atlantic City on a July day, and expect him to give punctual attention to a discussion of electric wires and their ways. Even the enthusiasm of the electrical contractors, which is certainly equal to that of any similar organization, is hardly equal to this supernatural human task. Nevertheless the convention must be considered a success.

The most noteworthy feature, at least from the outsider's viewpoint, was the address by Mr. Charles L. Eidlitz, the well-known electrical contractor of New York. The gist of his argument was that the electrical contractor should do business on a profitable basis by refusing to compete with cut-throat estimates, which carry with them the inevitable necessity of "skinning the work," to a greater or less extent, and that by rigidly adhering to a fair margin of profit for strictly conscientious and first-class work he will win in the end, and both increase his profits and place his reputation and work upon a higher plane.

Such a course sometimes requires a degree of patience and philosophy, as well as a bank account; but, given these conditions, honest work will always command a fair remuneration.

The electrical contractors undoubtedly have some serious problems which still remain unsolved, but the only hope of their ultimate solution is not only continued but increased unity of action on their own part. That the association is the best medium through which this can be accomplished there is little room for doubt. So long as the association stands for strictly ethical and honorable methods of dealing, high-class service, and progress in the art and handicraft represented, it will be a benefit to both the contractors and the public.

That illuminating engineering is an important adjunct to the contractor's business was brought out by an address given by Mr. Bauder. Unfortunately, there are many contractors who still hug the delusion that illuminating engineering is a manufacturer's ruse to sell goods; the sooner they disabuse themselves of this notion the better it will be for their own welfare. Illuminating engineering is just as important to their own progress as electrical engineering, and they should lose no time in attaching this powerful ally to their support.

Advertising the Municipality

Scientists on advertising agree on one point: Where the interests advertised are seeking permanent, cumulative, and definite results, the on-coming generation must be considered. And if there is any one thing that youth loves it is light. Old age and maturity may tolerate and approve good lighting for its unquestionably beneficial results from every point of view, but youth fairly revels in light. The young man and the young woman seek the light, for, like themselves, it is bright, vigorous, and cheerful.

To secure immediate, as well as permanent, results, the one most effective method of civic advertising is by the use of illumination, especially ornamental street lighting. It makes a city talked about and regarded as a progressive community, both by the young and the old. Furthermore, as has been proved in several instances, the use of electric sign lighting has produced wonderful results by increasing population and the business which population creates.

As pointed out in a recent issue of *Printers' Ink,* progressive cities are spending immense sums of money on publicity. Obviously there is a growing tendency on the part of cities to regard themselves as business institutions—and like other kinds of business the municipality must advertise to be successful.

Every lighting company in the country should see to it that its own city be fully posted on the value of illumination as an advertising medium. The field for co-operation along this line has been hardly more than touched, considering the importance of the subject.

To the Editor:

The July edition of your paper containing an article by me, entitled "Ascertaining Mean Candle Power and Flux from Photometric Curves," has just been received, and I note with regret that the table printed on page 253 is not complete, and that the idea of it is, therefore, not apparent. Below is this table as it should be, with six columns instead of three. The idea is to have a number of sheets printed with these tables, which sheets can then be used for recording, in the second column, the candle power values of a light source, and also for calculating and recording, in the fourth and six columns, the values of the corresponding flux in lumens. When sheets are complete, duplicates can readily be obtained by blue printing.

Very truly yours,

J. S. CODMAN.

Zone. Degrees.	Mid-zone candle power.	Lumen constant.	Lumens.	Zone. Degrees.	Lumens.
0 to 10....	...	0.0954	...	0 to 10	...
10 to 20....	...	0.283	...	0 to 20	...
20 to 30....	...	0.463	...	0 to 30	...
30 to 40....	...	0.628	...	0 to 40	...
40 to 50....	...	0.774	...	0 to 50	...
50 to 60....	...	0.897	...	0 to 60	...
60 to 70....	...	0.992	...	0 to 70	...
70 to 80....	...	1.058	...	0 to 80	...
80 to 90....	...	1.091	...	0 to 90	...
90 to 100....	...	1.091	...	0 to 100	...
100 to 110....	...	1.058	...	0 to 110	...
110 to 120....	...	0.992	...	0 to 120	...
120 to 130....	...	0.897	...	0 to 130	...
130 to 140....	...	0.774	...	0 to 140	...
140 to 150....	...	0.628	...	0 to 150	...
150 to 160....	...	0.463	...	0 to 160	...
160 to 170....	...	0.283	...	0 to 170	...
170 to 180....	...	0.0954	...	0 to 180	...

Notes and Comments

HOW THE DIFFERENT CITIES ARE PROMOTING THE CAUSE OF MORE AND BETTER LIGHT

CHICAGO, ILL.

Chicago can doubtless claim the title, "Electric City," with as good right as any city in the world. She is the happy possessor of a central station that for progressiveness and efficiency is an acknowledged model that other central stations are glad to study, and in addition to this, is doing something in the central station business on her own account through power furnished by her drainage system. Added to these good fortunes is the fact that the city electrician is a live student of the subject of public lighting, and possessed with the commendable spirit to make Chicago the best lighted city on this continent. The necessary legal formalities have been practically concluded, according to the *Post,* by which the city

will have 10,000 additional street lights from its own electric plant; and one of the first uses for the additional lamps is to be the brilliant illumination of the City Hall Square. This suggestion is due to City Electrician Carroll, and is heartily endorsed by Commissioner of Public Works Mullaney, through whose department the location of new lights will be determined.

The numerous installations of decorative public lighting that have been put in throughout the country by private subscription is a rather serious reflection upon the progressiveness of our municipal governments, and it is a hopeful sign to see some of the larger cities taking hold of the matter in earnest.

Philadelphia, Pa.

Since the installation of memorial lamp standards around her City Hall, nearly two years ago, Philadelphia has been constantly agitating the question of more and better public lighting. The next result of this agitation was the installation put up on Market street. It is now definitely settled that a handsome installation of decorative lamp posts will be put up around Independence Hall and Independence Square. Great credit is due the city electrician, Mr. McLaughlin, for his capable and effective handling of the practical side of the question. He is a thorough believer in a better lighted Philadelphia, and that his ideas are apparently soon to be consummated is a credit both to himself and the office which he fills.

Mr. McLaughlin proposes to place lamp standards on isles of safety in Broad street, which will add greatly to the convenience, as well as the appearance, of this unusual thoroughfare. The offer of the Philadelphia Electric Company to erect the standards and isles should not be overlooked, and speaks well for their spirit of civic pride.

Duluth, Minn.

This City of the Lakes is soon to have an extension of her "White Way," according to the *News-Tribune:*

"A new lighting system for West Superior street is practically assured, according to members of the committee representing the West End Commercial Club, which has been securing signatures of property owners and business men whose property between Eighteenth avenue and Twenty-second avenues west will be affected by the White Way.

"Most of the owners have consented to stand the expense of installing the new lighting system, and the tenants and business men have agreed to pay the cost of maintenance."

Richmond, Va.

As an example of how one good turn not only deserves, but gets another in the way of decorative street lighting, the case of Richmond is hard to beat. The *Times-Despatch* contains the following:

"Without a single dissenting voice, the Council Committee on Electricity last night awarded to the McKay Engineering Company the contract for the underground connections for the proposed Broad street ornamental lights.

"The result of this action is that within a short time Broad street will be brilliantly illuminated at night, making it indeed the 'Gay White Way' of the entire South. This is a step which has been heartily advocated by merchants along Broad street, and by many others who believe that it will add very much to the attractiveness of the city.

"Believing that the proposed extensive lighting of Broad street, while unquestionably helping the merchants along that thoroughfare, would accomplish little in the way of advertising the city, the business men of Main street have begun a movement looking to similar lighting of all the streets leading from the three downtown railway stations. The Broad street lights, it is understood, will not be antagonized.

"It was believed that the best impression would be made if the visitor could see well-lit streets from the moment of his arrival at the station of any railroad entering the city, continuing on Main, the street of skyscrapers and modern business structures, and taking him to Broad if he desired to go there."

Buffalo, N. Y.

Buffalo once attempted to steal both the thunder and lightning of Niagara Falls power by styling itself the "Electric City." In point of illumination at least, this title has never been acquired by either right of conquest or discovery, the city having shown little progress in public lighting since Niagara power was first brought to its streets. It is a pleasure to note its awakening to the advantages and necessities of modern street lighting. From the *News* we clip the following interesting item:

"Genesee street merchants will not be disappointed in their plans for better permanent illumination of the street and last evening the

Executive Committee on behalf of the Carnival Association voted to have the General Electric Company provide additional and better lights, the cost to be borne by the taxpayers and business men of the street. In explaining the plan George Urban, Jr., chairman of the Illumination Committee, said:

"'The new standards fitted with five ornamental tungsten lights at a distance of 150 ft. apart will provide ten times more light than is had at the present time. To get this plan through by the time the carnival arrives it requires quick action. At the present time the city pays $56 per arc light, and it will cost but $37.50 to maintain the five lights upon each of the standards, so you can see that in addition to getting ten times more light we are also saving money for the city.'"

Elgin, Ill.

Here's another example of how good lighting once begun is bound to spread. The following item is from the *News:*

"City surveyors, who have been determining the lines for the location of the decorative lights about Fountain square, have extended their lines up the downtown streets converging at the square so as to have the preliminary work done in case the decorative system is spread throughout the business district."

Altoona, Pa.

Altoona merchants know a good thing when they see it, according to the *Times,* and decorative street lighting is unquestionably a good thing:

"Two handsome street lights have been erected by the Penn Central Electric Light Company in front of their offices in the Mateer Building, on Eleventh avenue, and are attracting much favorable attention from business men and pedestrians. The base of the lights is composed of iron, coated with bronze, and stands about 11 ft. high. Around the top are five 100-watt tungsten lamps. Already a number of business men have ordered the lamps and will have them installed in front of their places of business."

Sharon, Pa.

Competition seems to be a good thing in lighting, as well as in business. No city or town can long remain in gloom amidst well-lighted neighbors. The *Telegraph* has the folowing item:

"South Sharon is to be a better lighted town than Sharon in the near future if the proposed contract with the Youngstown Consolidated Gas & Electric Company is made, according to an official of that company who states that with the new and improved lights the town would be brilliantly illuminated."

BLUE GLASSES FOR WORRY

When your nerves are on edge and you are in the blues, you should, it appears, look out on the world through glasses—not couleur de rose—but of peacock blue!

Are you tired, irritable, overworked, "jumpy," in want of a holiday? Do you feel that you need green fields and the cool splash of running water? Are you inclined to despair because at the time you cannot obtain such luxuries?

Despair no longer! Buy a pair of blue spectacles. Here is the explanation given by a doctor who himself frequently uses the latest nerve soother:

"When a man is badly in need of a holiday, or when his nerves are on edge from the worry, anxiety and bustle of modern life in towns, he instinctively longs for the green of the country," he said. "Not entirely, as might be thought, from a desire to get away from the bustle.

"The reason lies deeper—in the well-known physiological fact that red rays of light are exciting; green or blue are soothing.

"In ordinary town life, the red rays predominate, though there may be no actual red about, or very little. In the country the reverse is the case—green fields, green trees, blue sky make up the view.

"Whether in town or country, the rays operate on the brain through the eyes. When one's nerves are overwrought, therefore, the obvious remedy is to go into the country or take refuge in a blue or green room.

"But we cannot all do either, and to those who cannot my advice is—buy a pair of blue spectacles.

"The best tint I have discovered by experiment is peacock blue. Why this exact shade is the best I do not, as a matter of fact, know, but it undoubtedly is."—*Philadelphia Inquirer.*

Getting Rich Quick

By Guido D. Janes.

Art Phoenis wandered around his farm under an umbrella for two weeks with a lump in his throat. His wheat crop was ready to cut, but the rain would not let him cut it. No, and to make matters worse the said umbrella leaked.

"Unless every bit is harvested by the end of the week I'll lose it," he said. "The grain will fall out of the heads and I'll possess straw instead of riches at a dollar and a quarter a bushel. It is useless to hope. I'll commit suicide."

Lowering the umbrella he placed same under his arm and strolled over toward his stock pond. He was about to jump in when a flux of light suddenly came out from behind a bunch of clouds.

THE SAID UMBRELLA LEAKED.

"Too late, old Sol," sighed Art, looking at the just-arrived sun. "You can't assist me. If you would show yourself twenty-four hours instead of twelve I might work a double shift and get in my $15,000 crop. Your regenerative flame is not a constant quantity. You——"

Here the sad farmer stopped, looked up, and smiled. Over his head ran the feed wires from the Catawba Power Company's water power plant.

"I have a scheme," he cried, suddenly and hopefully. "I'll do it."

He thereupon abandoned his idea of putting himself to soak and hurried into his rural residence. There he telephoned to the Catawba folks:

"Say," he said, "have you any spare metallic arcs, flame arcs, 100-watt tungstens or other luminaries? If so, you can get yourself and myself rich quick." (Pause.) "All right, bring them along, and I will put you next to the plan."

Mrs. Phoenis all the while gazed at Art. She was in the habit of giving persons spherical ratings, and after the receiver was hung up, naturally jumped on him with both feet.

"This continued rain has inverted your intellect," she remarked. "For the last few kilowatt hours you have acted foolish. Please go to the insane asylum and have a new fuse put into your mind."

"Hee, haw," was the humorous answer to this. "My mind, wifie, is a regular tungsten placed on a 500 direct current. To prove it, I'll buy you a new silk dress

UNLOADING THE ILLUMINATION.

when I go to New York next month.

"All right."

By this time the central station man from Catawba, two miles distant, drove into the yard. His wagon was crowded to overflowing with helpers, lamps, transformers, foot-candles, practical illumination and wire.

"Well," he began, after requesting his horse to stop. "I am here ready to get-rich-quick. Does it require photometric measurements or not?"

"No."

"Well, I was going to say that if it did, the angle of incidence equals the angle of reflection."

"You ain't crazy, too, are you?" asked Mrs. Phoenis, using her apron for a handkerchief. "Please don't follow in the footsteps of my daffy better half."

"She is kidding you, Mr. Central Station," smiled Art. "Now to business. You install all your illumination in my wheat field, tap the feed wires for current, and I'll pay you $500. Is that not getting rich quick?"

"Sure. It is easy money and no mistake. Boys," he added, addressing his assistants, "to work! Fill this farm with electric lights."

Art now strolled to the barn where his 22 hired hands were still killing time. They were playing button-button, who's got the button, and did not know the rain was over.

"Now, boys," he said, upon reaching the place, "the sun has come out at last. Clear weather is at hand. But even then it would avail nothing unless we resort to a bit of diplomacy. I am not going to divide you into two shifts, but keep you as one. In other words, we must labor along in the wheat until the job is done. We have until day after to-morrow morning."

"How about carrying on our vocations in the dark?" asked Walt Henderson, the foreman.

"Don't worry about that. Do as I say, and you'll get time and a half."

"Very well, then."

Out into the drying field poured the harvest hands, and out into the field poured the illuminating men. While one worked with binding twine, the other labored with insulated wire. When supper time came one bunch of the men had concluded the task. After the meal night came upon the scene, and turned daylight into ink. Yes; it obliterated everything and put the green grass and the yellow wheat into one color.

Mrs. Phoenis had been treating the whole proceeding as a joke, so when she had washed the dishes, she came out into the field in the gathering gloom to guy her husband. She had just reached the place and had a couple of guy words on her lips when Art threw in a switch and at once the wheat field jumped out of night and into the daytime, as it were.

"Goodness," she cried in an hysterical manner.

"Don't be alarmed, dearie," laughed her husband. "You see I've put electric lights all over this locality so that I can harvest by night as well as day. The crop to me, if it is gathered by day after to-morrow, is worth $15,000. If not until that time I lose $1000 a day. The illumination cost me but $500. So you see, both the light men and myself are getting-rich-quick."

"Dearie," gasped Mrs. Phoenis, "forgive me and my skepticism." (Faints.)

The central station man observed this, and rushing up with an electric fan soon

HARVESTING THE CROPS.

had it throwing fresh atmosphere onto her countenance.

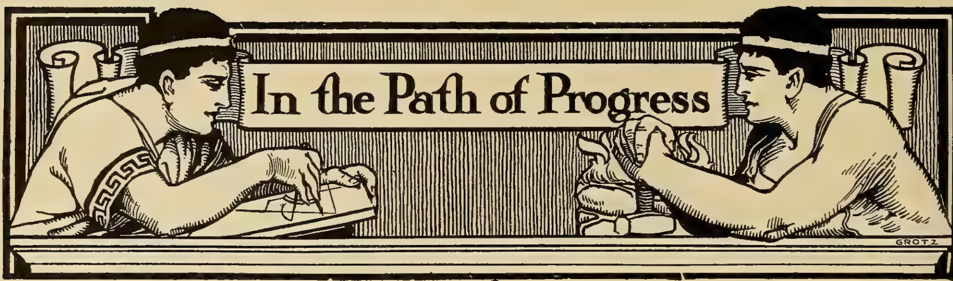
"She'll come to presently, Mr. Phoenis," he said softly. "But I want to tell you here, that you are a genius. Any one who can save a crop by diplomacy ought to be lauded to the skies. The way your men are working now you'll finish the harvest on schedule time. You have a nice wife, too."

"Thanks," sighed Mrs. Phoenis, regaining consciousness again. "You flatter me."

"No, I do not, madam. I am sincere."

"All right then. Now for the silk dress."

NOTE.—Mr. Janes' humorous and whimsical description of harvesting by the aid of electric light is an illustration of the old saying that "there's many a truth oft spoken in jest." The thing was actually done in Kansas last year.—ED.



The Lights of Minneapolis, Minn.

The commercial advertising value to a city of decorative street lighting has been exhibited and commented upon in numerous ways in our columns, and many and convincing are the evidences given. A very neat little folder of envelope size, issued by the Publicity Club of Minneapolis, not only puts the case most forcibly, but by the simple fact of its issuance bears testimony to the value of the decorative street lighting installation. The front, or cover page, of this folder is reproduced below.

The text of the leaflet is as follows:

THE MINNEAPOLIS LIGHTS AND WHAT THEY MEAN.

Minneapolis is a pioneer in artistic street lighting. All its retail district is now illuminated by specially designed posts, each bearing a cluster of five tungsten lights inclosed in large opal globes. These posts, set eight to a block, supply an ample and pleasing illumination at night, and both night and day contribute materially to produce an elegant and metropolitan effect.

As originally projected by the Minneapolis Publicity Club, this special lighting system included only the main retail thoroughfare but the installation was literally such a brilliant success that the services of the Publicity Club have been in demand ever since by property owners and tenants who have through this agency co-operated to extend the system throughout practically the entire down-town area.

The Minneapolis street lighting system is much more than a mere means of illumination and ornamentation. It is the strongest recent evidence of the spirit of Minneapolis which stands not only for material progress but also for co-operation in providing the equipment which makes a city desirable for homes as well as for business. It is the same spirit which has secured for all time to Minneapolis residents a park system which is so broadly planned that no home in the city is more than 10 minutes from some park and so extensive that there is an acre of park to each 150 of population. It is the same spirit which has enabled Minneapolis to build up a notable public library, to support one of the few fully equipped symphony orchestras in the country, to maintain churches and schools and art galleries. This sort of civic equipment, freely provided

COVER DESIGN OF LEAFLET.

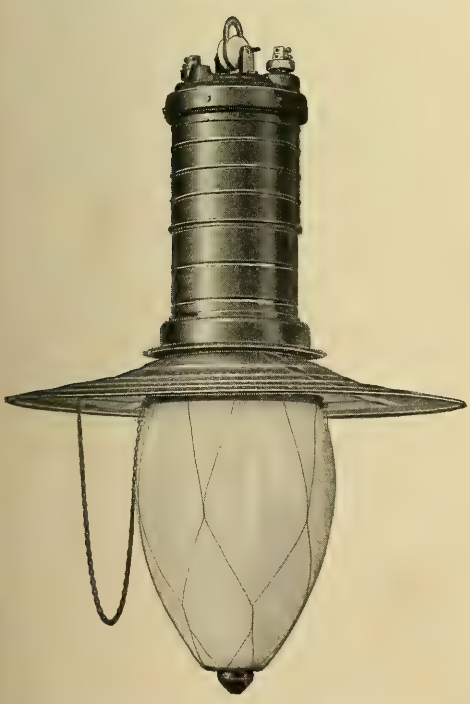
for all alike, has attracted the sort of people who make a live city in a business way; a city which has developed to a high degree of efficiency and imposing magnitude all the machinery for transacting business.

Minneapolis is prosperous because she provides opportunities for recreation and improvement for her wage earners and wage payers alike. She is progressive because her people pull together for the common good. The lights are the big visible evidence, but they are only one evidence of the Minneapolis spirit.

We hear on good authority that the city of Chicago is putting in decorative lamp standards at the rate of about one thousand a month, all of which are private installations.

A New Vertical Carbon Flame Arc Lamp

Since its first introduction into this country some five years ago, the flame arc lamp has made steady progress in popularity and use. Holding the record, as it does, for efficient light production from the electric current, it is inevitable that it must continue to make progress so long as it holds this enviable position. Any improvements, therefore, which extend its field of application are of importance to the electric lighting industry.



THE NEW GENERAL ELECTRIC VERTICAL CARBON FLAME ARC LAMP.

The following communication from the General Electric Company, Schenectady, N. Y., will therefore be read with interest:

VERTICAL CARBON FLAME ARC LAMP FOR D. C. SERIES, MULTIPLE AND MULTIPLE SERIES SERVICE.

Previous to the advent of the 6.6 ampere vertical carbon D. C. flame arc lamp, manufactured by the General Electric Company, the installation of flame arc lamps on 6.6 ampere D. C. circuits was not entirely satisfactory on account of the large and wasteful resistance necessary. This new lamp is designed for connecting directly in a 6.6 ampere D. C. circuit, without any change in the system, simply replacing the other lamps where desired.

Although these lamps are now made for D. C. service only, they find a wide application, being suitable for lighting squares, parks or special store sections in cities where the 6.6 ampere series luminous arc or the series D. C. enclosed 6.6 ampere system is used for street lighting. They are adapted for multiple and multiple series service in addition to the above.

The lamps are equipped with a light opal globe and a 26-in. diffuser. The casing, which is of copper, with black oxidized finish, is made up in two sections, so arranged that by telescoping the sections the mechanism is exposed, rendering it unnecessary to remove the entire casing in order to see that the lamp is properly trimmed.

The arc is held in the same position at all times, as the mechanism is of the focusing type. With the exception of this feature the lamp mechanism is similar to that used in the standard D. C. enclosed lamp, which has given perfect satisfaction during years of service.

The lower carbon holder is provided with a ball and socket joint to allow perfect alignment of both carbons.

A life of about 20 hours is obtained with one trim when the lamp is adjusted for 6.5 amperes.

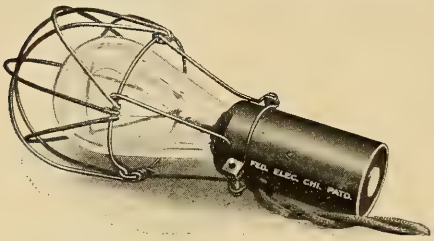
The design and the materials used are such as to combine attractive appearance, great strength and durability, with minimum weight.

Particular attention is called to the increased illuminating efficiency obtainable—an average of 2800 mean lower hemispherical candle-power places this lamp on a basis 50 per cent. higher than the average flame lamp manufactured in this country or abroad.

A Magnetic Lamp Socket.

While the idea of attaching an electric lamp to any iron or steel support by magnetism is by no means new, a simple and

practical device of this kind has not before, to our recollection, been placed upon the market. Little explanation is needed, the principle of construction being sufficiently apparent. A small electro magnet in the socket is placed in series with the lamp filament, so that when the lamp is burning the socket will attach itself to



THE FEDERAL ELECTRIC COMPANY'S NEW MAGNETIC SOCKET.

ILLUSTRATION SHOWING SOCKET IN USE.

any iron support. Innumerable cases where this would prove the greatest possible convenience will at once suggest themselves. A special small socket is provided for the use with a miniature lamp for automobiles. The device is put out by the Federal Electric Company, Chicago.

The Exhibition Rooms of the United Gas Improvement Company, Philadelphia

The value of a complete exhibition room of lighting and other appliances placed in a prominent position in the business section of the city has been recognized to a large extent by the electrical interests, Philadelphia being no exception. That a similar display of gas appliances is equally valuable in attracting attention and educating the public to their use would seem to be a foregone conclusion.

Probably the most conspicuous display rooms of this kind up to the present time are those recently opened in Philadelphia by the United Gas Improvement Company. These display rooms occupy the basement and first two floors of the building located at the corner of Eleventh and Market streets, the upper floors being devoted to offices and other purposes of the company. The building is naturally made an object lesson in modern gas illumination. A model gas lighted living room and dining room are shown as special features. A modern gas kitchen, of course, is one of the chief attractions. The entire display has been admirably arranged and is well worth a visit simply as an exhibition. That it is financially profitable is proven by the surprisingly large volume of business which is transacted daily in the various departments.

An Ingenious and Effective Window Sign

The great majority of store windows at the present time are examples of wasted opportunities for advertising effects that will at the same time enhance the attractiveness of the window. The generally accepted method of lighting a window is by lamps placed at the top and provided with concentrating reflectors. The top of the window, which is often in a separate section, is thus entirely useless, and if prismatic reflectors are used the light which they transmit is likewise wasted.

An effective and practical method of utilizing this waste of space and light has been worked out by the Federal Electric Company, Chicago, who are introducing it under the trade name of "Win-do-lite" sign. The device consists of a metal framework supported by a section of iron tubing at the top. To this tube is attached a number of sockets fitted with

lamps of the desired candle power and prismatic reflectors. The framework is made to receive leaded glass letters, which are placed side by side, so as to form any word or sentence desired. The light transmitted by the reflectors is ample to illuminate this sign so as to bring out the letters with their striking color effects, at

THE WIN-DO-LITE SIGN.

the same time the reflected light can be used for the illumination of the goods in the window. A general construction and appearance of the sign is indicated in the accompanying illustration.

A New Line of Highly Artistic Illuminating Glassware

While crystal, opal, and frosted glass are unquestionably the most efficient in transmission and reflection of light, there is an admittedly large number of cases in which efficiency is of entirely secondary importance, artistic effect being the chief end sought. In such cases color can be used to an unlimited extent, with the sole provision that it is handled with the same delicate appreciation of harmony that the mural painter must possess in order to be successful. Nothing is more staring in its vulgarity than gaudily colored or painted glassware, for the reason that transparency adds largely to the brilliancy and hence to the gaudiness.

On the other hand, there are opportunities for delicate shadings by transmitted light, and irridescent and shell-like effects by reflected light in the case of glass that are unattainable with any other material.

These facts are taken advantage of with a remarkable degree of skill and artistic taste in a new line of glassware being put out by the Steuben Glass Works, Corning, N. Y. The general name of " Aurene " has been given to this new line of decorative globes and shades. They come in a large variety of highly artistic shapes, and are hand-decorated in a most exquisite manner, showing rich hues by transmitted light, and exquisite metallic and irridescent effects by reflected light. While of necessity such goods cannot be cheap, the prices are reasonable considering their intrinsic merit.

Announcement

A number of changes in the personnel of the Holophane Company, Newark, Ohio, were announced at the company's annual conference, which was held at the Sagamore, Lake George, New York, July 10 to 16.

Mr. W. F. Minor has been appointed assistant general manager; Mr. C. Walter Jones, formerly manager of the New York branch, succeeds Mr. Minor as sales manager; Mr. John W. Foster succeeds Mr. Jones as manager in New York, while H. D. Howe takes charge of the fixture department, which will be located at Newark, Ohio.

The 1910 Holophane conference was the most successful in the company's history, 102 persons being present. Of these, ten were wives of various members of the organization and eighteen were invited guests, the latter including representatives of the National Electric Light Association, the National Electric Contractors' Association and the Electrical Supply Jobbers' Association.

American Items

NEW BOOKS.

"MUNICIPAL FRANCHISES," by Delos F. Wilcox, Ph.D., Chief of the Bureau of Franchises of the Public Service Commission for the First District of New York. Volume One—Pipe and Wire Franchises. 662 pp. Cloth, $5.00 net. Engineering News Book Department, New York.

This is undoubtedly the most exhaustive work on the subject that has yet appeared, and the peculiar facilities and opportunities enjoyed by its author for accumulating data and information render it an unquestioned authority on the subject. The franchises of various cities are analyzed for the purpose of drawing general conclusions.

The titles of the twenty-one chapters are as follows:

Chapter I—How Franchise Rights Are Acquired; II—What a Franchise Signifies; III—Monopoly Profits, and Ways of Limiting Them; IV—Injuries to Individuals and Ways of Preventing Them; V—Temptations to Public Wrong and Ways of Overcoming Them; VI—Electric Light, Heat and Power as a Public Utility; VII—Franchise Conditions Imposed on Electric Light and Power Companies; VIII—The Telephone; IX—Telephone Franchise Regulations; X—The Telegraph and the Conditions Imposed Upon It by Local Authorities; XI—Messenger and Signal Franchises; XII—Electrical Conduits; XIII—Water Works and Water Supply Franchises; XIV—Sewer Franchises; XV—Central Heating Franchises; XVI—Refrigeration Franchises; XVII—Pneumatic Tubes and the Franchises Under Which They Are Operated; XVIII—Oil Pipe Line Franchises; XIX—Artificial and Natural Gas as Public Utilities; XX—Gas Franchises Where Only Artificial Gas Is Available; XXI—Gas Franchises in Cities Within Reach of Natural Gas Fields.

INDEX TO THE PROCEEDINGS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION, 1885-1909. National Electric Light Association, 25 West Thirty-ninth Street, New York. 243 pp. Cloth.

The association has just issued, in a limited edition of 1000 copies, a complete cross-reference index to the reports of all the conventions from 1885 to 1909, inclusive. This edition is being distributed to all the member companies down to 1909, and to the officers of the association who filled executive positions during the period. This plan leaves a few copies on hand for general distribution, in response to inquiries from libraries and other institutions that may happen to have a full set of the *Proceedings*. It is obvious that the index is of little direct use to those who are without a full set of the *Proceedings* to which the index makes reference; while to the fortunate possessors of a set the index is a key to a vast accumulation of immensely valuable data.

The book is uniform in size and binding with the *Proceedings*, and fills 243 pages. It includes a general index; a list of 24 classes into which the topics are divided; an excellent synopsis of papers and discussions; an authors' index; a title index. Several hundreds of important topics are noted, with treatment or discussion by hundreds of authors, and the book comes as a fitting finale to the first quarter century of the association's operations in the central station field.

ELECTRICALLY OPERATED MACHINE FOR CLEANING GLASSWARE; *Electrical World*, June 23.

The article describes an apparatus de-

signed by the electrician of the Federal Building, Chicago, for cleaning glass reflectors, 4000 of which are in use in the building. The apparatus consists of a small truck on which is mounted two washing tanks and a small motor equipped with a buffing wheel. One of the tanks contains soap suds and the other clear water, the former being used to wash and the latter to rinse the reflectors. The water in each tank is thrown up in a stream from the bottom by electrically driven propellers. The washing tanks hold sixty reflectors at a time, and it is said that they can be washed in three minutes. The absolute necessity for keeping lighting accessories, whether of glass or metal, reasonably clean is not yet sufficiently recognized. As far as we know, this is the first effort to lighten the labor of this work by modern mechanical methods.

USE OF FLAMING ARCS FOR A LARGE ARENA; *Electrical Review and Western Electrician*, July 16.

A description of the illumination of the Army Tournament, Grant Park, Chicago.

DECORATIVE LIGHTING AT TERRE HAUTE, IND; *Electrical Review and Western Electrician*, July 23.

An illustrated and descriptive article of the recent installation of decorative street lamps in that city. Concrete posts with cluster tungsten lamps are used.

IMPROVEMENT OF ELECTRIC LIGHTING IN OLD CARS, by C. R. Gilman; *Railway Electrical Engineer*, July.

The article begins by quoting at length from a paper by T. W. Rolph on "Reflectors for Incandescent Lamps." The writer then makes the following observations:

Treating the subject as a whole, there are a number of conditions that must be considered. First—We all want our cars brilliantly lighted; we wish this lighting to have the refinement of "good taste." "Good taste" varies in individuals, depending on education and environments. However, we all know what the phrase stands for and we wish to have our work above criticism. Second—We want to light our cars economically. This word economy, although it may embrace all the details of lighting cars, in this particular case means to me the least amount of current that will produce the lighting effects desired.

LIGHTING WITH 500-WATT MAZDA LAMPS, by Roscoe Scott; *Selling Electricity*, July.

An illustrated article describing the lighting installation in a new dry-goods store, Cleveland. Diagrams and illuminometer readings are given.

TOWER LIGHTS, by "R"; *American Gas Light Journal*, July 11.

A brief discussion and review of tower lights, both ancient and modern, showing how gas can be successfully used for this purpose.

FORMS OF HANDS AND THE LIKE FOR HALL ROOM LIGHTS, by "Engineer"; *American Gas Light Journal*, July 18.

A curious article describing and illustrating a number of gas burners supported by representations of the human hand.

FLAMING ARC LAMPS, by Newton Harrison; *The Central Station*, July.

A somewhat detailed discussion of the subject, with figures as to comparative costs, candle-powers, etc.

MODERN GAS FIXTURES, by Thos. R. Elcock, Jr.; *Progressive Age*, July 1.

A detailed description of the lighting fixtures exhibited in the new showrooms of the United Gas Improvement Company, Philadelphia, fully illustrated.

GAS ARC LIGHTING, by A. H. Johnston; *Progressive Age*, July 1.

This is article Number 2 in the prize competition offered by this journal. Treats the subject principally from the technical and practical side. As the writer has had experience in this line, his advice may be taken as authoritative.

GAS ARCS VS. GASOLINE, by Edward F. Kelley; *Progressive Age*, July 15.

In the opening paragraph Mr. Kelley gives figures concerning the extent of the gasoline lighting industry. The balance of his article, which is fairly exhaustive, is given to an analysis of the claims of this

system of lighting, with arguments to be used by the gas interests in refutation. There have been placed upon the market in the past 10 years no less than 100,000 gasoline lighting machines. There are four large manufacturing and operating companies, and their chief business is the manufacture of gas machines for commercial use. The wonderful growth of these companies would seem to indicate that they find a ready buyer for their products. These companies make the basis of their operations and find excellent working capital among the dissatisfied gas and electric consumers in the larger cities and towns, particularly in the West and South. Considering that they do very little, if any, advertising, their success in placing these plants is even more striking, and in some cities the gas company has had to "sit up and take notice."

New York's Model Display and Demonstration Building; *Progressive Age*, July 1.

A fully illustrated, descriptive article of the display rooms of the Consolidated Gas Company, New York.

Hamilton's White Posts, by E. A. Howe; *Progressive Age*, July 15.

Describes and illustrates a number of installations of gas arcs supported by white lamp posts for decorative street lighting in Hamilton, Ontario.

Gas Lamp Outlining; *Progressive Age*, July 15.

Gives night and day views of the outlining of the Grand Rapids Gas Company, with outside inverted burners.

The New Street Lighting, by E. Leavenworth Elliott; *The American City*, June.

An illustrated article giving a summary of the advantages of modern decorative street lighting.

Flashing the Hour from the Metropolitan Tower, by Joseph T. S. Baker; *Scientific American*, July 16.

Descriptive article illustrated with a full page reproduction of the Metropolitan Building by night. The subject has been treated in a previous number of this magazine.

A Colossal Illuminated Advertising Display; *Scientific American*, July 9.

An illustrated article describing the "Leaders of the World" sign, recently erected in New York City.

Studies in Thermo Luminescence, by C. A. Pierce; *Physical Review*, June.

A highly technical article giving the results of experiments conducted by the writer at Cornell University.

A Laboratory Arc Lamp, by Edward F. Northrup; *Physical Review*, July.

Describes an extremely simple form of sulphur arc lamp for laboratory use. The lower carbon holder plates in a well of mercury.

EDITORIALS.

Portable Standards of Light; *Electrical World*, July 14.

Electric Lighting Statistics; *Progressive Age*, July 1.

Foreign Items

Compiled by J. S. Dow.

ILLUMINATION AND PHOTOMETRY.

First Annual Meeting of the Illuminating Engineering Society in London (*Illum. Eng.*, London, June; *Gas World*, May 28, etc.).

In the previous review reference was made to the last meeting of the session of the Illuminating Engineering Society (London). A full account of this meet

ing will be found in the *Illuminating Engineer* (London) for June, and a number of technical journals have also taken notice of the matter. Of special interest is the report of the council for the first session, which is reprinted in extenso.

Public Lighting from the Municipal Standpoint, by J. Abady (paper read before the Institution of Gas Engineers; *G. W.*, June 18; *J. G. L.*, June 21).

The author discusses three forms of street lighting contracts: (1) That based on the supply of a given energy, including maintenance by the contractor; (2) that based on the supply of energy, the maintenance being undertaken by some outside party; (3) that based on the supply of a given amount of light. He contends that in the case of the first two types of contracts there is no inducement to *both* parties to adopt the most recent methods of lighting, but that this defect is remedied by the third method. He then proceeds to describe the form of contract recently entered into by the Westminster City Council. This specifies that the lamps shall give a certain candle power, which is to be checked by measurement of the mean of the values at 20 and 50 degrees to the horizontal. This mean value, the author suggests, is nearly always practically identical with the M. Hem. Sph. C. P. The remainder of the paper is given up to a discussion of the spacing of lamps, best height of lamp-posts, etc.

The Illumination of Interiors, by Prof. J. T. Morris (two lectures delivered at the East London College, June 8 and 15).

In these lectures the author dwelt upon daylight illumination as compared with artificial methods. He specially pointed out the need for absence of glare and showed some curves illustrating the contraction of the pupil aperture of the eye with varying intensities of light. He also gave some curves illustrating the variation of daylight illumination. A specially interesting feature was the presentation of some diagrams showing the fluctuations in illumination on various underground railways in London.

Illumination: Its Distribution and Measurement, by A. P. Trotter (Continued, *Illum. Eng.*, London, June).

In this installment the author describes the Martens Illumination-Photometer and the Wingen instrument. He also refers to the use of shutters and diaphragms as a means of adjusting the illumination of the photometer discs. This method is employed in connection with the Simmance Abady street photometer.

Shop Window Lighting (*Illum. Eng.*, London, June).

An article referring to several examples of show window lighting shown at the exhibition in Berlin. Attention is drawn to the different views of the purpose of window arrangement. In some cases the idea is to make the window a sort of catalogue of all the goods inside. In others all that is intended is to exhibit a few choice articles, and to produce a specially striking effect. The former method is apt to lead to overcrowding of the window and renders successful illumination difficult; the latter method is the more artistic. There seems a great need for an expert who understands *both* illumination and window dressing.

Methode zur Berechnung der Vertikalflachenbeleuchtung und der Horizontalflachenbeleuchtung, by P. Högner (*E. T. Z.*, June 9).

The Quality of Light (*J. G. L.*, June 21).

Notes on Illuminating Engineering (*Electrical Field*, June).

ELECTRIC LIGHTING.

The Use of Metallic Oxides in Arc Lamp Electrodes, by Dr. B. Monasch (*Illum. Eng.*, London, June).

The article is given up to a description of the shape and color of the arc-flames of various metallic oxides. Titanium, vanadium and metals of this group seem to give the best results. In conclusion the author describes an experiment with an arc struck between electrodes of Nernst material. The luminous efficiency

was not very high, most of the light coming from the incandescent solids rather than the arc itself.

THE USE OF PHOSPHAM IN METALLIC FILAMENT LAMPS (*Elec. Engineering*, June 16).

DIE NEUE "ELECTRIC LIGHTING ACT" (*E. T. Z.*, May 19).

GLUHFADEN - MESSINSTRUMENTEN (*E. T. Z.*, May 19).

Describes a type of apparatus for clamping and readily determining the resistance of a filament.

FORTSCHRITT IM BAU VON GLUHLAMPEN-ARMATUREN (*Z. f. B.*, June 20).

Analyses of the design of the ordinary glow lamp holder. The author suggests the use of thick and substantial glass as an insulator. He also shows a type of shade which can be fitted straight into the holder, and so form an effective portion of the insulation.

FLAME ARC LAMPS CARBON DEPOSIT (*Elec. Rev.*, 10, 17, 20).

Correspondence regarding the effect of the fumes from arc lamps. One correspondent finds that these fumes form a deposit on the window which neither acids nor alkalis can remove. It is suggested, however, that this is a consequence of using fluorides in the cores of the carbons. These etch the glass, and their effect can naturally not be wiped out by any chemical. It is stated, however, that the effect is not found troublesome in the case of flame arc lamps in which this ingredient is not used.

GAS, OIL, ACETYLENE LIGHTING.

SAVINGS ACCOMPLISHED BY DISTANCE GAS LIGHTING, H. Dobert (*J. f. G.*, June 18).

The author discusses the question whether the results theoretically obtainable by using distance gas lighting devices can be realized in practice. He described an actual case in his experience in which a very considerable saving was effected.

PETROL AIR GAS, by Prof. C. A. M. Smith (lecture delivered at the East London College, June 22).

This lecture dealt in a general manner with petrol air gas lighting, several types of plants being exhibited. The lecturer laid special stress on the number of points in connection with the subject on which research was needed. For example, more definite information was needed regarding the best pressure to use with burners of this class. It was also pointed out that users of petrol had at least one advantage —that the calorific value of the fuel was pretty definite. Users of gas, on the other hand, could not be certain what calorific value they would obtain so since the quality of gas varied in different localities.

LARGE CANDLE-POWER, HIGH PRESSURE UNITS ON VIEWS IN LONDON (*J. G. L.*, June 14).

Refers to the new high candle-power gas lamp recently installed in Aldwych, London. These lamps are credited with over 4000 candle-power. It is interesting to observe that preparations are made to send gas into the mains in this locality at a pressure of 70 to 80 inches of water.

INSTITUTION OF GAS ENGINEERS; annual meeting (*J. G. L.*, June 21; *G. W.*, June 18).

BRITISH ACETYLENE ASSOCIATION; annual meeting (*Acetylene*, June).

NEUE INVERTBRENNER, GLUHLICHT FUR FLUSSIGE BRENNSTOFFE, ETC. (*Z. f. B.*, June 10, 20).

Contractions used:
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminating Engineer (London).*
J. G. L. *Journal of Gaslighting.*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The
Illuminating Engineer

Vol. V SEPTEMBER, 1910 No. 7

CHARITY, PHILANTHROPHY, HUMANITY; BUT THE GREATEST OF THESE IS HUMANITY

Charity cares for the unfortunate and for the poor; seeks to uplift, but stoops in doing so; binds up wounds rather than seeking to prevent them; devotes its attention to the individual; expects no benefits in return.

Philanthropy rises a step higher in the ascent of man from barbarism. It seeks the good of all human beings collectively, and without hope of any material gain. The only recompense of the philanthropist is the approval of his own conscience. Philanthropy seeks to give to man as a present, for which gratitude is expected in return, that which is his by divine right, and for which he owes no other man thanks or gratitude.

Humanity would give every individual his birthright, and so, by putting him in possession of his own, realize the highest condition of civilization for society, or man collectively and individually.

Charity would succor the traveler left penniless and dying by the roadside; philanthropy would build a spacious hospital in which he might find shelter and care until healed; humanity would make the highway safe from the attacks of the vicious, so that the traveler would not be left bleeding by the wayside, but could go his way in peace and safety.

To provide the best possible illumination for those who labor is neither charity nor philanthropy, but an act of simple humanity; it is only giving the individual his just right, viz., to receive his full share of the benefit of the great discoveries and inventions of modern science. While charity and philanthropy labor without hope of material gain, humanity invariably benefits in a material way the giver as well as the recipient.

Give the laborer good light, and he must, by the eternal laws of nature, repay it tenfold in the better and larger results of his labor.

Let no one take unction to his soul, nor vaunt his own righteousness, when he gives those who labor for him the best light, and the best facilities that science affords. He is but investing his resources in securities that never depreciate, and that never pass a dividend.

The watchword of human progress to-day is "HUMANITY."

Let every one have his full share in the glorious heritage of science: Let there be more and better light.

E. L. Elliott.

Illuminating Engineering

What It Is; What It Has Done; What It Is Doing

By E. Leavenworth Elliott.

The use of electricity in the production of light was a scientific discovery that particularly appealed to the people. Electricity itself has always been a mysterious force, and endowed in the popular mind with marvelous and supernatural properties from the days when Jupiter hurled it as the thunderbolt to the time when our own Franklin performed his memorable experiment with the kite. Electricity was, and still is, a word to conjure with; and the natural appetite of the human mind for things miraculous put it in a receptive state for any wild or wonderful claims that might be made for the new scientific wonder—the electric light. And the light itself in its first form, the arc, was sufficiently spectacular, as compared with all other light-sources then known, to attract universal attention. Unquestionably the electric light is responsible for the greater interest in and use of artificial illumination which has developed into such enormous proportions at the present time.

First Stages of All Improvements Are Crude.

History shows that the first use of new discoveries and inventions is crude and wasteful. The great epoch-making improvements have not burst upon us in full glory like the rising of the sun, but have been preceded by years of patient and obscure toil, and have grown to maturity through additional years of trial and experiment. To this rule the electric light has been no exception. Unquestionably superior to all its predecessors in many important points, it found a ready acceptance on the part of a public that had been fascinated with its mysterious origin and sensational appearance; and the expected happened, that is to say, the *use* of the light of this new source for the ordinary purposes of illumination was so little considered, and in general, especially in this country, so poorly done, that the results were seriously, often shockingly bad.

By a rather remarkable coincidence the researches of Dr. Auer von Welsbach gave rise to a new method of producing gas light that, had it not been overshadowed by the more spectacular invention of the electric lamp, must also have proven a matter of general wonder. Thus, within the space of a decade the entire system of producing light underwent a complete revolution.

The immediate effect of a political revolution is usually a condition of unstable equilibrium, and a greater or less degree of license and violence. The result of the revolution in light production, so far as illumination is concerned, followed the same law. There was more and more *light*, to be sure, but too often worse and worse *illumination*. When the arc and incandescent electric lamp and the Welsbach mantle had lost their novelty, and been brought to a state of commercial perfection, there followed an awakening on the part of the more observant to the fact that these revolutionary inventions were being so used as to give very faulty results, and that, like all good things, unless used intelligently were sure to prove evils rather than blessings. Not only were the results poor, but often wasteful to the extreme.

Gradually the belief became a conviction that the proper use of light is quite as important an item as its economical production. With the increasing misuse of light there came at length to be an increasing number of investigators studying how to avoid this misuse and reap the full benefits of these really great inventions and discoveries. At last this movement for betterment in lighting assumed a name; and from that time forward has stood apart as a new individual among the list of arts, sciences and professions.

Illuminating Engineering Meets Opposition at First.

Such in brief was the origin of illuminating engineering. Like all other new arts or professions, illuminating engineering has had to defend its right to existence. It is strange, but true, that every movement and effort toward bettering the condition of mankind has invariably met with strenuous opposition, chiefly on the part of those whom it has especially aimed to benefit. The way of the transgressor is hard, but the way of the uplifter is far harder. Let no one delude himself with a notion that people are anxious to accept improvements, whether in material or moral things. They must be shown, persuaded, argued, cajoled, threatened, beaten into better ways. It is only the devil who needs no department of publicity.

Illuminating engineering, in brief, is an effort to make better use, or perhaps we should say the *best possible* use, of artificial light; and now that the means of producing light have become so numerous and scientific, and the purposes of light so complicated and various, this effort may well absorb the energies of an individual for the entire period of his life's work.

The Various Attacks on the Profession That Have Been Overthrown.

In the development of this new science and art history repeated itself, as was to be expected. There were the usual number of those who scoffed at the idea and belittled it, vainly hoping that this upstart might thus die of inanition. The scoffer is one who denies facts which he knows nothing about. It would be scientifically inaccurate to call him empty-headed; his head is too thick to have room for emptiness. There are none so blind as those who will not see; the scoffer neither will nor can see, and is therefore blinder than a statue. Others cried out that illuminating engineering was only a ruse, and that those who professed it were full of guile; that the whole thing was only a deep-laid plot to sell—let us be absolutely frank for once—prism glass! It required no inordinate acumen to discover that this particular class of detractors was made up largely, or at least led by those who had other glass to sell, or were indirectly interested in its sale. A man may hold his tongue when his corns are stepped upon, but never when his pocketbook is trod upon.

Then there were those who said that there was really nothing new in the idea; that they had been placing lights for years quite to the satisfaction of their clients—by which it will be understood that their clients had not actually pulled the lights down and hurled them back at their heads. And lastly, like all new sciences, illuminating engineering suffered from the charlatan and fakir. Let us be frank again and admit what is obvious to one who has watched the movement—that it was used to no little extent as a mere salesman's trick to sell goods, and that many professed the title who had as little real claim to it as a patent medicine "fiend" has to that of being a conscientious physician. But we do not discredit the science of medicine because it is used as a cloak by the unscrupulous; nor is it any more just to decry illuminating engineering as a science because of a similar abuse of its fair name.

Illuminating Engineering Stands For Better Conditions.

On the whole illuminating engineering has no just cause for complaint of the reception that it has received at the hands of the public, nor the progress that it has made since it came into its title some five years ago. It stands for improvement, for betterment, for truth, and can no more be damned by faint praise, nor outlawed by calumny, nor discredited by fakirs than can any other positive factor for good in the world's progress.

Having thus in a general way traced the origin of illuminating engineering and outlined its purpose, we may pass to the more definite and more useful task of pointing out some of the work that it has already accomplished.

As in all cases of positive improvements, illuminating engineering has benefited both manufacturer and consumer, both the buyer and the seller, to an equal extent. To give workers the best possible illumination is a humanitarian act. Humanitarianism is distinguished from char-

ity and philanthropy in bringing *material* benefit to the giver as well as to the recipient. *It pays* to give operatives good illumination; no stigma should attach to this statement, for it is by the practice of intelligent humanitarianism that civilization will advance, rather than by the exercise of charity and philanthropy.

First Efforts Were in the Line of Economy.

Illuminating engineering very properly and wisely directed its first efforts along economic lines. By showing where money saving could be made attention was drawn in a convincing manner to the defects in lighting that were not only wasteful, but injurious to those using them. The first great good, therefore, accomplished by the rise of illuminating engineering as a science and profession has been to call public attention to practices that were inhumanitarian—if we may coin a word—*i. e.,* that were injurious to both those practicing them and those subject to the results. The worst of the abuses in the use of artificial light have been largely obliterated. The semi-dungeons in which thousands of people used to labor, with aching eyes and strained nerves, are happily a thing of the past; and this is due almost entirely to the propaganda of illuminating engineering, chiefly for commercial reasons. The worst atrocities in lighting have been hunted out by those interested in the new movement, and the economic faults of their existence brought home to those responsible for them. To be sure, this has not always been the work of professed illuminating engineers, but it has been the work of those who have at least been educated to a recognition of the abuses of light by the illuminating engineering profession.

Defective Eyesight Increasing.

There seems to be no doubt of the fact that defective eyesight, as evidenced by the increasing use of glasses, has become much more prevalent since the introduction of modern intense and high power light-sources; and the fact is equally indisputable that a very considerable measure of this increase is directly due to the misuse of these light-sources. Coincidently with the exposition of the wastefulness and inefficiency of ordinary methods of using light, illuminating engineering called public attention to the direct injury to the eyes and the collateral evils produced by eye-strain. Oculists and optometrists have done much to correct the faults of defective vision and to relieve the suffering caused thereby, but they have not gone beyond the conditions of the eye as presented to them by their clients.

Practically nothing was done toward public education in regard to the danger inherent in ill-considered methods of illumination until the profession of illuminating engineering was established. The value of this work is incalculable and has only just begun to make itself felt. The effect of eye-strain directly upon the nervous system, and indirectly upon every function of the body, is now beginning to be recognized. It is unquestionably one of the most important and fruitful fields for investigation by those interested in the public health, and particularly those in charge of public education, that exists at the present time. Illuminating engineering endeavors to find those methods of using light which best subserve the purpose of vision, which means that the proper care and preservation of the eye is the foundation of the science. Thus every problem worked out involves a consideration of the functions of the eye, and calls attention directly or indirectly to the importance of a just appreciation of the proper use of the visual organs.

Examples of Surprising Saving Effected by the Application of Illuminating Engineering.

The money saving, which served as the most attractive feature by which to secure initial interest in the subject and which is by no means to be neglected, is not the most important end to be obtained. That such money saving, however, can be accomplished, and to a greater extent than would be believed without investigation, there are plenty of concrete cases to prove. A single one will serve to illustrate the point. A large new hotel was put up in the Broadway district in New York City some five or six years ago. The lighting installation, including the size and location of sources and the character of the

fixtures, was, according to the prevailing methods of the time, the work of the architects, with such assistance from the electrical engineers and fixture manufacturers as they chose to obtain. They were practically unlimited in their expenditures for this item. The building was supplied with electric current from its own plant. This was one of the first problems given careful study by illuminating engineers; and after a year's work the illumination had been greatly improved in quality, and the cost, which was represented only by the item of fuel, reduced some $500 per month.

About a year ago the capacity of the hotel was doubled by an addition to the building, and so great have been the economies in current secured by illuminating engineering practice that it was found practicable to light the entire building from the plant originally installed to light a building only one-half the size. The most remarkable fact in this case is that the changes in the system were not primarily made for the purpose of securing economy, as the hotel was exceedingly profitable from the start, but were made for the purpose of improving the quality of the illumination—*i. e.,* of removing the numerous objectionable features which existed in the original installation. Equal economies have been secured in numerous other cases.

It is safe to say that mistakes and blunders of a like magnitude will rarely be made henceforth. To cite a single instance to substantiate this prediction: When one of the finest of Chicago's new hotels was being projected, both the architects and the president of the company made a careful investigation of the subject of lighting, not only seeking the advice of illuminating engineers, but personally investigating the subject as exhibited in prominent hotels in other cities, as much to discover the faults of ordinary practice as to avail themselves of any especially good points.

Illuminating engineering has thus impressed upon the public to a large degree that illumination is one of the most important of modern conveniences and facilities, and that it must be as carefully considered as any of the more material features of a building.

Creating Public Sentiment for Better Lighting.

Creating public sentiment and knowledge conducive to a better use of light has of necessity compelled the manufacturers of light-sources and lighting appliances to cater to this public demand. The manufacturers, generally speaking, however, have not waited to be compelled, but have themselves taken the matter up and become leaders in this campaign of education. The producers of luminants have spent thousands of dollars on maintaining illuminating engineering departments, and in various public methods of promoting the science and art of illumination; while the manufacturers of lighting appliances have been equally active in their efforts to produce ways and means of securing the greatest possible benefits from the improvements in light production. There is no broad-minded manufacturer who does not, for purely commercial reasons, prefer an intelligent customer to any other. He knows that intelligence appreciates quality, and is always willing to pay a liberal profit for quality and satisfaction; and that, furthermore, the intelligent customer who purchases with discrimination, not what he can get for the least money but what he believes will give him the greatest satisfaction, is the least likely to change his allegiance when he has found by experience an article or a line of goods that meets his approval. The central stations and gas companies vastly prefer to have every one of their customers posted on the best possible methods of using light, and the manufacturer of a lamp or accessory of any kind would likewise choose a customer who fully understood the merits of the article than one who bought simply from fancy or from the argument of cheapness.

Illuminating Engineering Has Stimulated Industry.

Illuminating engineering has thus been stimulating in the most beneficial manner to all the industries connected with illumination. The old idea of selling lighting appliances on salesmen's talk and tricks has practically become extinct, and even when illuminating engineering has been used merely for the sake of appear-

ances it has at least served to call attention to the science, and has been a recognition of the fact that the seller has attempted to cater to the intelligence of the buyer.

While a great work has been done by the establishment of illuminating engineering, vastly more remains to be done, and the profession is not faltering in this work. Constantly greater efforts are being put forth along lines of scientific research to determine what are the best practices, and equal efforts are being made from the commercial side to put the theories into practice as fast as they are established.

Illuminating engineering stands for the better use of light, for the prevention of money waste, for the care and preservation of the eyes, for better art in the design of lighting fixtures and appliances, and for better methods of conducting the commerce of illumination. In all of these lines it has made substantial progress and is daily advancing. In this age progress takes no backward step.

An Old Reflector Rediscovered

In one of our previous issues we noted the simultaneous appearance of a special form of reflector designed for street lighting in the advertising literature of a manufacturer of electrical fittings and in a paper presented before the New York Section of the Illuminating Engineering Society. Such coincidents are by no means rare, as the contemporaneous invention of a device by inventors widely separated has been of more or less frequent occurrence.

It now develops that the particular reflector referred to was not only invented, but made and put into commercial use some ten or more years ago. The illustration shows an old-fashioned gas lantern which has been equipped with a Welsbach burner and a reflector, which though not identical with the one mentioned still embodies exactly the same principle, the only difference being that it is conical instead of parabolic, being made of metal lined with sections of silvered glass. Some 200 of these posts were put up in the city of Toronto at the time mentioned.

This fact, however, by no means convicts either of the inventors of plagiarism. The rediscovery of facts previously known is another one of the common occurrences in the line of scientific discovery and invention.

STREET LAMP PUT UP IN TORONTO ABOUT TEN YEARS AGO.

The Illumination of a Cotton Mill

By A. S. Hubbard.

In the illumination of textile mills the question as to whether general or special lighting shall be employed has not been authoritatively answered, judging by the present diversity of practice. It is so simple a matter to improve upon the old hit-and-miss methods by a reasonably intelligent use of either system that plenty of cases may be found where each method is giving apparently entire satisfaction.

The question of the method of distributing the light units, however, is by no means the most important one. As the real measure of efficiency of a lighting installation is the facility with which work can be done under it the *quality* of the light used becomes a more important matter than the details of distribution. So long as all commercial light-sources used carbon, or a solid, as the radiant, giving light of substantially the same quality—*i.e.,* having the continuous spectrum characteristic of such radiants, the question of quality did not particularly enter into the problem. With the development of a light-source using the vapor of mercury as the radiant and giving a spectrum entirely different from that of the ordinary solid body radiation, the question of quality at once entered the problem of industrial illumination as one of its most important factors.

The one obvious characteristic of the spectrum of the Cooper Hewitt or mercury vapor lamp is the total lack of red rays, resulting in the familiar greenish-

FIG. I.—WEAVING SHED, SHOWING EFFECT OF ELECTRIC INCANDESCENT ILLUMINATION.

FIG. 2.—WEAVING ROOM, PRODUCING FIGURED GOODS, SHOWING EFFECT OF COOPER HEWITT ILLUMINATION.

blue color of its light. This novel and unusual characteristic at first seemed to be a serious handicap to the usefulness of the light, but gradually the fact became recognized that color distinctions are only occasionally important in industrial processes, and this fault thus proved more imaginary than real. Furthermore, the fact developed that the radiations from this source possess peculiar and marked properties which are exceedingly valuable for a great variety of industrial purposes, among which the textile industry perhaps affords the greatest field for their utilization.

The most noteworthy of the characteristics mentioned is the marked increase in visual acuity which results from the use of peacock-blue light. Put in simple language it means that the eye can distinguish small objects and fine details of line with greater ease and clearness by the light of the mercury vapor lamp than by the light of any source giving a continuous spectrum, or so-called "white light." By far the larger number of operations in the textile industry involve the handling of fine fibers and threads. The advantage of any light that will increase visual acuity is at once apparent.

The particular installation which will be discussed in this article is a mill working largely on the best grade of white cotton duck, some special figured piece goods being manufactured in addition. The mill produces the finished product from cotton yarn; the processes, therefore, consist of spinning and weaving. The mill is the largest producer of this particular line in the United States, and works night and day turns. It was originally, and is still, partially lighted by 16 candle-power carbon filament lamps equipped with metal reflectors, dropped on cords from the roof.

Fig. 1 is from a night photograph of

the main weaving shed thus equipped. The dimensions of this shed are 128 x 166 ft., giving a floor area of 21,248 sq. ft. There are 306 lamps used in the installation. This number at 56 watts per lamp gives a total of 17 kw., or an expenditure of .806 watt per square foot of floor area. This was considered good lighting in its time, and the photograph represents very fairly the illumination produced as it will appear to the eye.

Fig. 2 is a view in one of the weaving rooms producing figured goods. The general appearance of the illumination is, as in the preceding case, fairly represented on the photograph. Fig. 4 is a detailed view of one of the looms. This room is of irregular shape, and contains 5093 sq. ft. of floor area. It is lighted by four-type P and two-type H Cooper Hewitt lamps, requiring 2310 watts, or an average of .453 watts per square foot of floor surface. The entire absence of black shadows and the uniformity of illumination is clearly brought out in the photograph, Fig. 2. Fig. 4 represents with some degree of accuracy the remarkable sharpness with which details appear under this light. Observe, for example, the thread from the shuttle and the distinctness of details of the fabric and looms.

Fig. 3 shows one of the aisles in the spinning room. This room measures 96 x 286 ft., half of which is lighted by 28

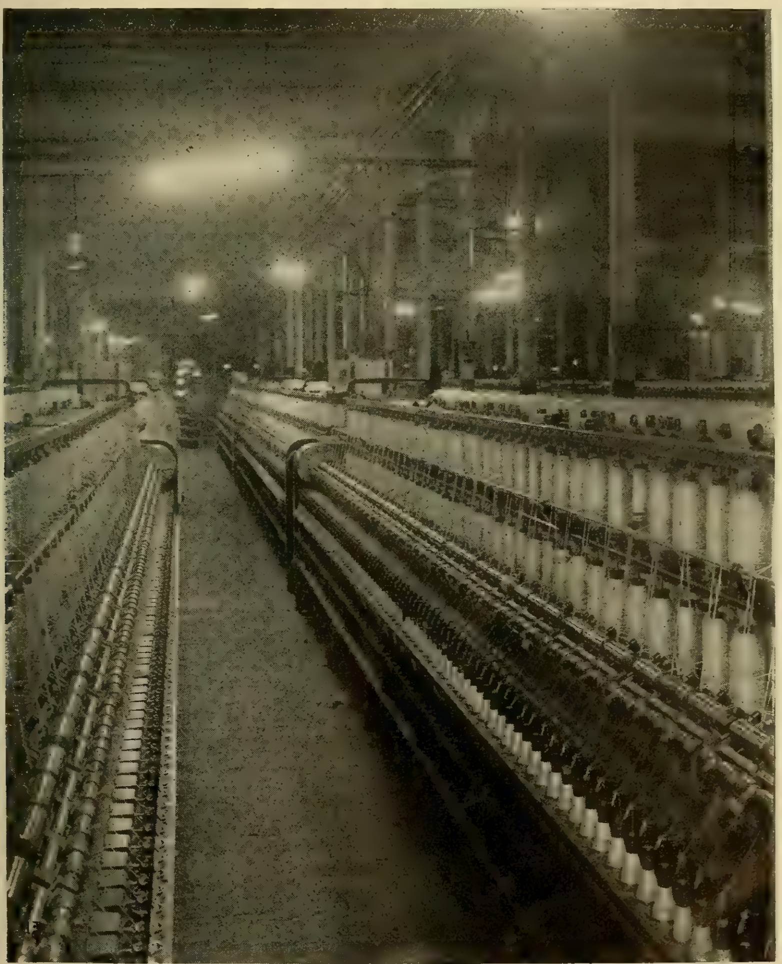


FIG. 3.—ONE OF THE AISLES IN THE SPINNING ROOM.

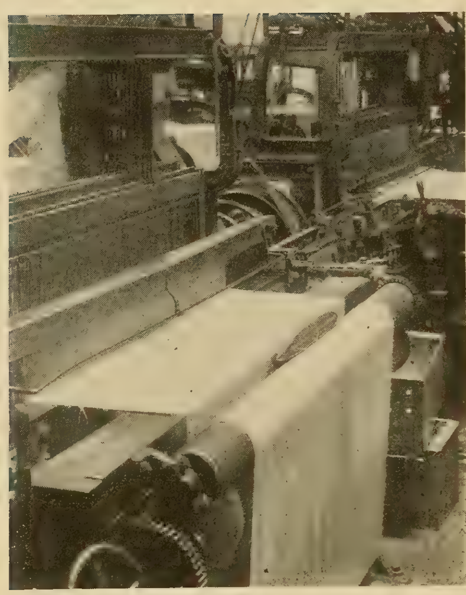


FIG. 4.—DETAIL VIEW OF ONE OF THE LOOMS.

type H, 6 type K and 21 type P Cooper Hewitt lamps, consuming 21,075 watts of current, or an average of .768 watts per square foot. This room has large windows on the north and south sides. To determine the relative acuity of vision under the light of the Cooper Hewitt lamp and north daylight a test was made with a number of operatives. These were asked to keep their eye on a particular thread at the end of one of the spinning frames, then gradually back away until they could just distinguish this thread. With one exception all the operatives found that they could distinguish the thread at a greater distance with Cooper Hewitt light than by daylight, the average being in the ratio of 17 to 21, or over 23 per cent. in favor of the former.

Fig. 5 is a view of the warping department, and is shown principally as an exhibit of the remarkable uniformity and distinctness with which the details are brought out.

It is asserted by various competent au-

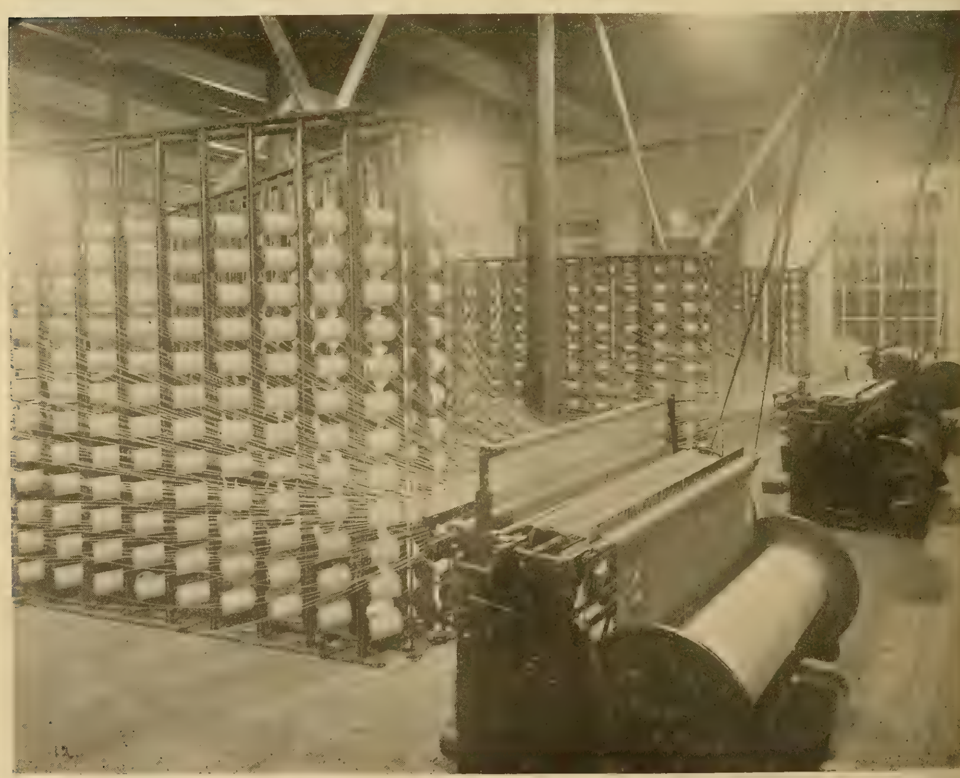


FIG. 5.—WARPING DEPARTMENT. NOTE THE DETAIL OF THE STRANDS.

thorities that eye irritation is principally the result of red and heat rays. The absence of such rays in the Cooper Hewitt lamp is unquestionably one of the principal reasons why those working under its light find the effect upon the eyes so pleasant, so far as fatigue and strain is concerned.

It is worth the further remark that this particular mill has given probably more careful attention to the details of cost of production and efficiency of labor than any other cotton mill in the country, and is, therefore, in a position to pass very accurate judgment upon the effect of illumination on production. Their experience has been that the product of the night turn, which is produced by the light of the Cooper Hewitt lamp, is in every way equal to that produced under daylight.

Illumination Requirements in Street Lighting

By Arthur J. Sweet.

During the earlier part of this current year the writer had the privilege of conducting a very thorough and extensive research * to determine the illumination requirements in street lighting. In view of the important influence which this research bids fair to exercise over actual street lighting practice, it has been suggested that a concise résumé of the results of the research would be of timely interest. These results are therefore summarized in the following numbered paragraphs, in considering which some allowance must be made for the fact that adequacy is here sacrificed to brevity.

1. The Fundamental and Most Important Requirement in Street Lighting Is the Elimination of Glare.—This is a more primary and vital consideration than the attainment of a satisfactory uniformity of illumination. Glare exercises a more serious influence in decreasing the effectiveness of a given illumination than has hitherto been generally recognized. An example or two will serve. In the case of the 80 c. p. incandescent lamp used with the radial wave or radial fluted reflector, such a degree of glare is introduced by the direct rays from the unit as reduces the true illumination to 60 per cent. of its apparent or illuminometer determined value. That is to say, equal sufficiency of illumination for disclosing objects and detail would be obtained if the intensity of illumination were decreased to 60 per cent. of its foot-candle value and the eye at the same time entirely shielded from all direct rays from the light unit. Sixty per cent. as here given is, of course, a representative figure, but may fairly be taken as expressing the mean under average actual conditions. In the case of the modern high candle power arcs, such a degree of glare is introduced by the direct rays from the unit as reduces the true illumination to 20 per cent. of its apparent or illuminometer determined value. In this case 20 per cent., while a fairly representative value, is a mean between relatively more marked extremes than is the 60 per cent. given above for the incandescent unit.

2. Glare Is Not Avoided by Low Intrinsic Brilliancy Within the Limit of What Is Practical in Street Lighting.—This is probably the most revolutionary fact established by the research above referred to. It means that we have all of us been mistaken in thinking to avoid glare by putting a diffusing globe around the light source. Such a diffusing globe does somewhat decrease the glare effect produced by the bare source, but apparently only in about the same proportion as it decreases, through absorption and redirection, the light flux in the direction of the eye. Diffusing globes are exercising an important influence in popularizing better street lighting. But the merit in their use should be recognized as chiefly artistic rather than as utilitarian.

3. Glare Effect Is Entirely Caused by Light Which Enters the Eye at Angles Less Than (Approxi-

* The formal report of this research was presented before the Franklin Institute and published in the May *Journal* of that body.

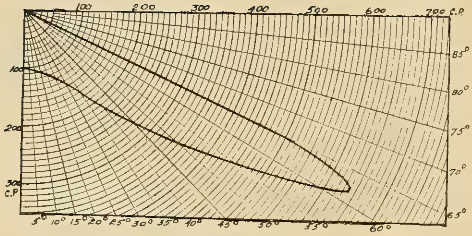


FIG I.

MATELY) 25 PER CENT. WITH THE LINE OF VISION.—In street traffic it may be assumed that the line of vision is normally along the horizontal or slightly below the horizontal, as in viewing the more distant roadway. Under this assumption, glare effect is entirely caused by light which emanates from the unit between the angles of approximately 65 and 90 degrees from the nadir.

4. GLARE MAY BE AVOIDED ONLY BY THE PRACTICALLY COMPLETE SUPPRESSION OF ALL LIGHT EMANATING FROM THE UNIT BETWEEN THE POLAR ANGLES OF 65 AND 90 DEGREES.—This inclusive statement is obviously made only with reference to the normal conditions of street lighting and street vision, as defined in paragraph above. The statement is strictly true at mounting heights of 15 feet and less, and sufficiently true for all practical purposes at all mounting heights common to contemporary practice. But the relative influence which angle and distance exercise over glare effect makes the statement less and less strictly true as greater and greater mounting heights, exceeding 15 feet, are considered. So that for mounting heights of, say, 150 feet, a condition actually existent in the old arc towers of former days, the statement is so inexact as to be misleading.

5. THOROUGHLY SATISFACTORY STREET LIGHTING WILL REQUIRE A SPACING BETWEEN ADJACENT UNITS OF NOT TO EXCEED FOUR TIMES THE MOUNTING HEIGHT.—The limitations imposed by the necessity of avoiding glare make it impossible to obtain a thoroughly satisfactory uniformity of illumination at separations greater than four times the mounting height. At separations of five times the mounting height glare may be

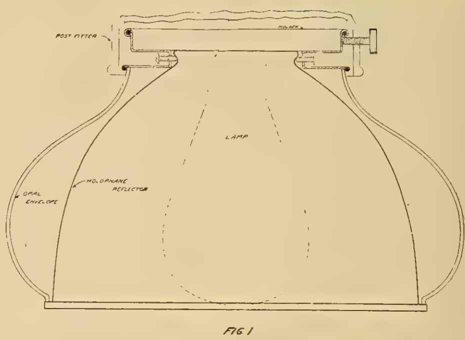


FIG. 2.

avoided and such uniformity of illumination obtained as, while not all that should be desired, may yet be regarded as a not too serious concession to commercial limitations. When the separation exceeds five times the mounting height, it is necessary to either tolerate a practically unilluminated area midway between adjacent lamps or to permit a seriously objectionable condition of glare to exist. The former is considered decidedly the lesser of the two evils. It is unquestionably the lesser evil in business districts, where window lights and signs contribute very materially to the general illumination. As the facts stated in this paragraph receive more general recognition, they will probably lead to the employment of somewhat greater mounting heights than are usual in present practice.

6. THE PROTOTYPE CURVE, TO WHICH THE LIGHT DISTRIBUTION OF THE ACTUAL STREET LIGHTING UNIT SHOULD CLOSELY APPROXIMATE, IS SUCH AS GIVEN HEREWITH IN FIG. I.

In order to meet the conditions of effective street illumination as developed by

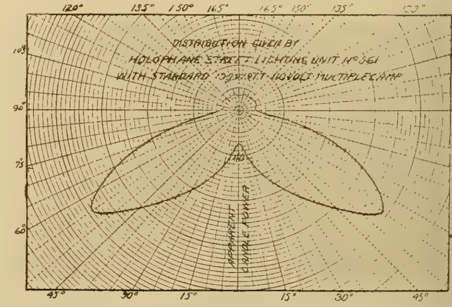


FIG. 3.

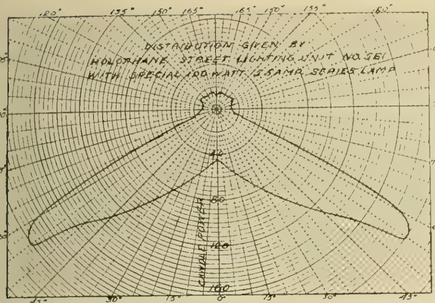


FIG. 4.

this investigation, the writer has designed a new combination diffusing and reflecting unit for use with the tungsten lamp. The construction of this unit is shown in the diagram, Fig. 2. It consists essentially of a Holophane prismatic reflector surrounded by an outside opal envelope, the two being held together by a suitable metal holder. The primary function of the opal envelope is to protect the reflector prisms from dirt deposit which, in the presence of the moisture incident to out-of-door service, would cut down the reflecting efficiency of the prisms. A metal envelope might, of course, be used to accomplish the same purpose, but it is considered desirable that the unit be visible by night, both on account of artistic considerations and in order to afford a marked effect along the course of the street.

When used with the standard multiple lamp this unit gives a materially lower degree of glare than any other unit of equal illuminating power with which the writer is acquainted. The several large manufacturers of tungsten lamps are now seeking to develop a special series lamp, and when this has been satisfactorily worked out it is believed that a street lighting unit giving complete absence of glare will be produced.

The curves of distribution of the present unit are shown in Figs. 3 and 4.

Its appearance in service in connection with a modern lamppost is shown in Fig. 5.

[The peroration of Mr. Sweet's Franklin Institute paper is so important that we take the liberty of quoting it here.—Ed.]

"This paper, obviously, is not addressed to the ordinary taxpayer. It is addressed to the scientist, to the manufacturer of street illuminants, to the central station superintendent, to the educated and public-spirited citizen. Let these work shoulder to shoulder in the education of the public and this must eventually become a reality in a no distant future. And the rewards, whether commercial and material or as pride in a useful service accomplished, will come first and in largest measure to those of us who join in the work. So working shoulder to shoulder, let us teach the public, teach them so thoroughly that it becomes a popular catch-word, 'Light on the object, not in the eye.' Let us teach them that this 'light on the object,' can be accomplished only by a closer spacing of light units, which will mean a larger increase in installation cost, though but a small increase in operating cost: that light 'not in the eye' means of necessity absence of glare; so that the excellence of a street illumination must be measured by absence of glare, rather than by the presence of glare."

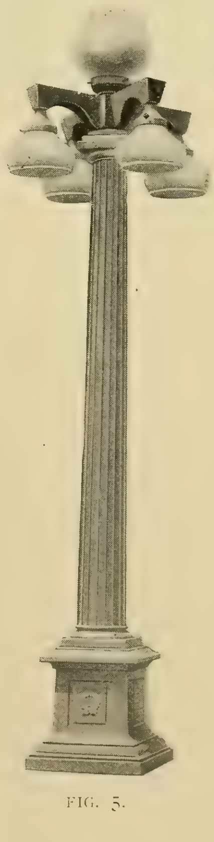


FIG. 5.

FIG. I.—TITLE SAVINGS & TRUST COMPANY, KANSAS CITY, SHOWING EFFECT OF INDIRECT ILLUMINATION.

An Interesting Indirect Lighting Installation in Kansas City

By W. S. Trader.

The development and progress of artificial light has brought the illuminating engineer and the fixture salesman face to face with the indirect or deflected system of illumination. Aggressive thinkers in the lighting profession have made countless tests, formed many theories, yet have installed but a few examples of so-called " hidden lights." In the every-day course of the fixture business the word *indirect,* as applied to light, was quickly and quietly hushed. The general public was kept in placid ignorance that there ever might be evolved a practical deflected system of lighting, all of which was good and proper, there being nothing tangible devised for indirect lighting. It entailed a freakish construction of upper walls and ceilings, unsightly recesses to conceal the lamps, and very little deflecting surface, but, worst of all, it eliminated the necessity for lighting fixtures completely, so the fixture interests and the illuminating engineer working hand in hand as they should gave the question of indirect lighting little or no encouragement.

The inevitable pioneer came forth and launched a well defined system of indirect illumination. This solved the problem first of scientifically correct reflectors,

which actually reflect all of the light rays and concentrate their energy on a surface from which these rays are deflected.

There is also a wonderful opportunity not only for daring and original effects, but the successful adaptation to any period of art. Some time ago the writer had occasion to confer with Messrs. Root & Siemens, architects, of Kansas City, relative to the lighting system of the Title & Savings Trust Company, and suggested the application of the indirect lighting system, also its adaptability to the Sullivanesque type of art expressed in this bank. The idea was favorably received, the architects supplied with the necessary engineering data and the system installed. The illustration, Fig. 1, shows how cleverly the architect blended the contour and detail of the plaster bowls with the interior treatment. The space was beamed into fourteen spaces each 14 x 22 ft.; width of room, 44 ft.; length, 98 ft.; ceiling, 18 ft. in height. For an illumination of 2 ft. candles on a 30-in. plane, three intensive type reflectors were installed in each fixture with 100-watt tungsten lamps.

In other words, in each bay, 14 x 22 ft., one composition bowl fixture, containing three 100-watt clear bulb tungsten lamps in concentrating type of reflectors, were installed.

With this wattage (300 watts) only 1 watt per square foot was used, to produce an illumination of 2-ft. candles.

The distance from the top of the reflectors to the ceiling figured 36 in. At the request of the architect eye tests were made, one fixture raised 6 to 8 in. above and below the 36-in. point, showing a very perceptable decrease of illumination.

The installation was more than favorably received by the architects and the officials of the Title & Savings Trust Company.

FIG. 2.—TYPE OF INDIRECT UNIT.

FIG. I.—FIRST AVENUE, CEDAR RAPIDS, IOWA, SHOWING ARRANGEMENT OF NEW ORNAMENTAL LAMP STANDARDS.

A Western Instance

Cedar Rapids, Iowa, is credited with a population of 27,948 (in 1900). We do not have at hand a statement of its total assessed valuation nor its wealth per capita; very likely there are many Eastern cities that surpass it in this respect. But it needs no rummaging among dry statistics to ascertain that in push and civic pride per capita this city of the prairie stands in the very first rank of American municipalities. A look at even a photograph of its "First Avenue," as shown above, is proof of this fact. It exhibits more than a "decent respect for the opinions of mankind"—it shows a carefully conceived and well executed scheme of municipal improvements intended not only to afford comfort and convenience to her own citizens, but to proclaim to the stranger within her gates that here is the abode of taste and culture as well as commercial prosperity.

The latest of these improvements is the unusually fine lighting installation which is such a conspicuous feature in the photograph. This consists of handsome lamp standards, as shown in Fig. 2, placed 68 feet apart, and "staggered" on opposite sides of the street. This arrangement has the advantage of giving a more uniform illumination on the pavement and of locating one standard at the alley entrance, thus lighting these byways.

Each standard is equipped with four 60-watt tungsten lamps in the pendant position and one 100-watt lamp in the upright position. All five lamps burn till midnight, when the four pendant lamps are turned off and the central lamp allowed to burn all night.

The cost of maintenance and current supply is $70 a year for each standard. This includes lamp renewals, cleaning of

FIG. 2.—TYPE OF STANDARD.

glassware, repainting standards and regular inspection. This is at the rate of 10 cents per front foot of property per month. The first cost of installation was $100 per standard, which was paid by the property owners. The cost of maintenance is paid by the tenants.

The value of such an installation as this to the local lighting company is far greater than the mere income from current. The agitation in favor of municipal ownership which was rife five or six years ago has dwindled into insignificance since the movement for decorative public lighting has swept over the country. Nine out of ten of such installations have been put in and maintained by private enterprises with the hearty co-operation of the central station. As was stated in this magazine some time ago, the most obvious argument against municipal ownership of public lighting was the lack of enterprise and push which was inherent in the system. Public interest in the subject of lighting was all that was needed to meet the arguments of the political agitators and cause a return to public sanity.

Spectacular Lighting a Century Ago

"There is nothing new under the sun," as we have heard repeated since childhood, and have seen verified times without number. Just as we are pluming ourselves upon some remarkable modern improvement we find that the germ of the idea, at least, existed years or centuries ago; and not infrequently we are obliged to admit that our present wonderful achievement was outstripped by our remote ancestors. We are accustomed to ascribe spectacular lighting, especially the "outlining" of buildings, to the peculiar adaptability of the incandescent electric light to this purpose. How many of us are aware that the most famous architectural structure of modern times was annually lighted up with a complete system of outlining years before the electric lamp was invented?

St. Peter's Cathedral in Rome, the masterpiece of that wonderful genius, Michael Angelo, is perhaps the best known of any single edifice in the world. Volumes have been written in description and praise of its wonderful construction and proportions. What more magnificent opportunity to exhibit the glories of architecture and produce a spectacle to amaze the world than the outlining of this huge pile with living light? To accomplish this at the present time with all the facilities of electricity at one's command would indeed be a task worthy of the best trained engineer; and yet this was done years ago with a light-source that to-day would be held in contempt—the little oil lamp.

In an old number of *Harper's Monthly* a description is given of the annual illumination and pyrotechnical display in Rome during Holy Week with a woodcut showing the illumination of St. Peter's in the background. The description and illustration are given in full.

Those magnificent proportions afford a fine opportunity for other than architectural display, and Rome is not slow to avail herself thereof. The solemnities and festivities of Holy Week at Rome are ordinarily terminated by what most visitors regard as the grandest spectacle of all, and by what certainly is, as a pyrotechnic display, without a parallel in the world. The American Fourth

of July fades into insignificance when compared with the illumination of St. Peter's. All the lines of the vast façade of the church, the roof, the ribs of the stupendous dome, the form of the lantern and the cross surmounting all—are traced out with rows of lamps or lanterns; and as the golden light of an Italian sunset fades away and the purple shadows of evening settle over the city, these are lighted, coming out like stars in heaven, until the whole structure blazes like a constellation. Every architectural line, every column, cornice, capital, every arch and entablature are pricked art in fire against the sky. Fireworks of the most brilliant description are set off also from the neighboring Castle of St. Angelo on Easter Monday night. It is difficult for any description to suggest the magnificence of the spectacle of the illumination of St. Peter's, because words cannot depict to the imagination the vastness of the edifice that is thus etherialized in light, and which, seen from a distance, seems to stand, or rather to hang, over the city above which it towers, "shining and glittering in the calm night like a jewel."

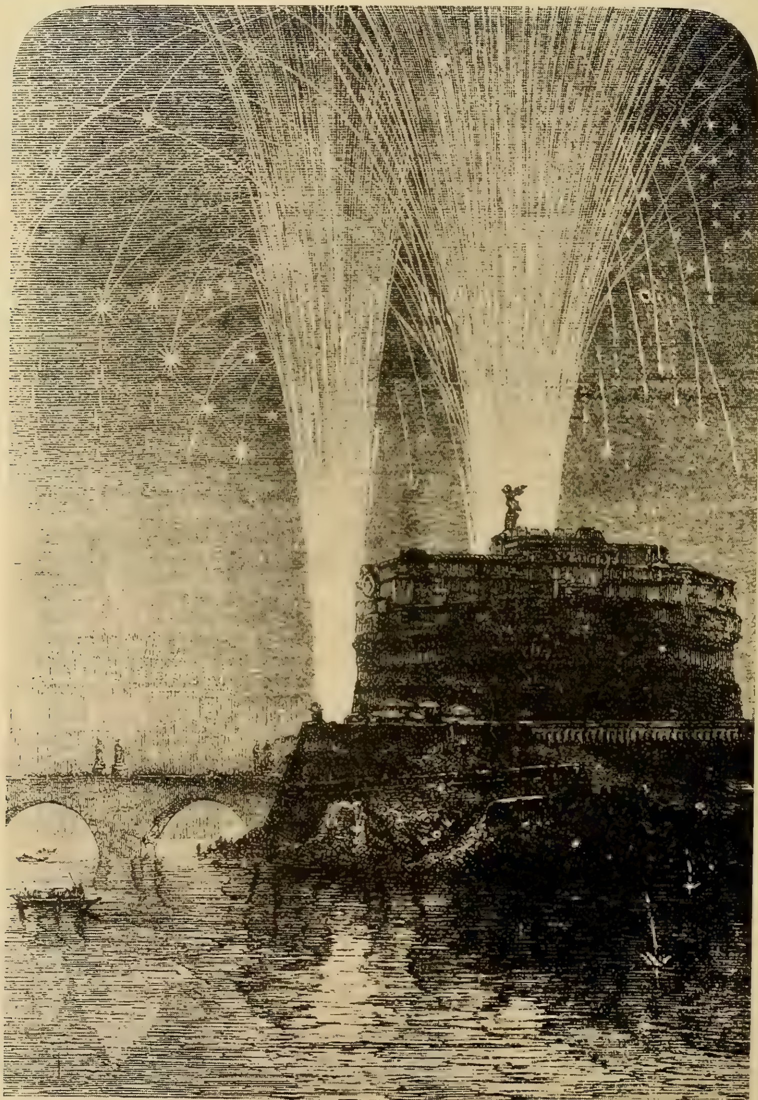


FIG. I.—SPECTACULAR ILLUMINATION, HOLY WEEK AT ST. PETER'S IN ROME ABOUT A CENTURY AGO, REPRODUCED FROM AN OLD PRINT IN "HARPER'S MONTHLY."

The Importance of Good Illumination in Factories

BY AN ENGLISH CORRESPONDENT.

In a recent article in this journal some remarks were made on the need for good factory lighting.* It was pointed out then, and it is becoming increasingly well recognized, that it is false economy to pay high prices for labor, and to purchase costly tools, and then to grudge the expense of providing sufficient illumination for the men to work in comfort. It was also remarked that although not much had hitherto been done by authorities in the way of recommendations on this point the need for more precise regulations was already felt to exist. Practically the only legislation insisting upon a minimum illumination for different classes of work seems to be that of Holland, where a minimum value of 15 lux for fine work is specified—a value which many might now consider could profitably be exceeded for very fine detail. It is interesting to see that M. Gariel, in a recent paper before the Société Ophthalmologique de France, mentions that the establishment of a similar standard has since been advocated in Paris.

A very striking official recognition of the importance of the matter, however, has been provided by the attitude taken up in the recently issued report of H. M. Inspector of Factories for 1909, in Great Britain. The general report, which precedes the local reports on special subjects in this somewhat bulky publication, this year contains an exceptionally full statement of the claims for better illumination, and it may be added that special acknowledgment is made of information derived from *The Illuminating Engineer* of London.

It is pointed out that "The Earlier factory acts are silent on the subject," and that even subsequent special legislation only deals with the subject in a very general manner. Nevertheless the report adds, bad lighting is fully admitted to have an injurious effect on health, safety and cleanliness, and the neglect of cleanliness which it occasions may considerably add to the risk of trades in which poisonous materials are handled.

The Home Office thus gives the weight of its official recognition of the need for good illumination. Naturally, however, too much must not be expected at once. Indeed, the chief difficulty is the lack of proper data on which to base recomendations. The department, therefore, proposes to feel its way cautiously toward definite conclusions and meanwhile it is organizing special investigations with the object of collecting information on the matter. For example, a number of tests of underground basements have already been examined and the results are tabulated in this report. In examining these premises the method recently utilized by Mr. P. J. Waldram, based on the examination of the "window efficiency," *i. e.,* the ratio between the unrestricted illumination outside and the actual illumination inside was used. In almost all the cases examined the illumination in this respect was very poor, values down to the order of one-tenth of a foot-candle being obtained. Other inspectors quote cases in which an apparent relation could be traced between the weak eyesight of operators and the poor conditions of illumination, etc.

The sympathetic attitude of the Home Office to this subject is considered very encouraging, and it is hoped that the precedent set will be followed by other governmental departments. Naturally the problem to be attacked is a very complex one and must be approached on sound and cautious lines. But the official recognition of the importance of the matter is all that is desired at the present moment.

* ILLUMINATING ENGINEER, January, 1910.

FIG. I.—VIEW SHOWING NEW INDIRECT ILLUMINATION OF AUDITORIUM, STEEL PIER, ATLANTIC CITY, N. J.

The Illumination of the Steel Pier Auditorium, Atlantic City

By Augustus D. Curtis.

The illumination of auditoriums is of the gravest importance. Where public gatherings are held the lighting appliances should be such that neither the pulpit or the stage on one hand, nor the auditorium on the other be inconvenienced or irritated by the lights. The abuse of the eyes of the public by direct glaring lighting units, a custom so very general, cannot be too severely condemned.

There has been an awakening as to the necessity of better illumination, and a great advance has been made in the art. In any interior where public gatherings are held there is now no excuse for any management to inflict upon the public an illumination that is injurious to the most delicate of the vital organs, the eye, and as well detrimental to the general health.

Illustrating one of the most recent installations of rational illumination is an interior view of the Steel Pier Auditorium at Atlantic City. This auditorium is used for conventions, exhibitions, dancing, musicales and on Sunday afternoons for sacred concerts. The arc lamps previously used were very unsatisfactory, and the management, casting about for the most comfortable and efficient method of illumination possible were attracted by the beautiful results secured in the South Shore Country Club Auditorium of Chicago, and visited that city for the express purpose of investigating it. The manager immediately decided upon an installation of similar nature.

Owing to the fact that the ceiling of the Steel Pier Auditorium was different in construction, being circular on the sides, they had some doubts as to the same results being secured, but by proper engineering, the placing of the proper number of indirect lighting units at the correct distance from the ceiling, the results

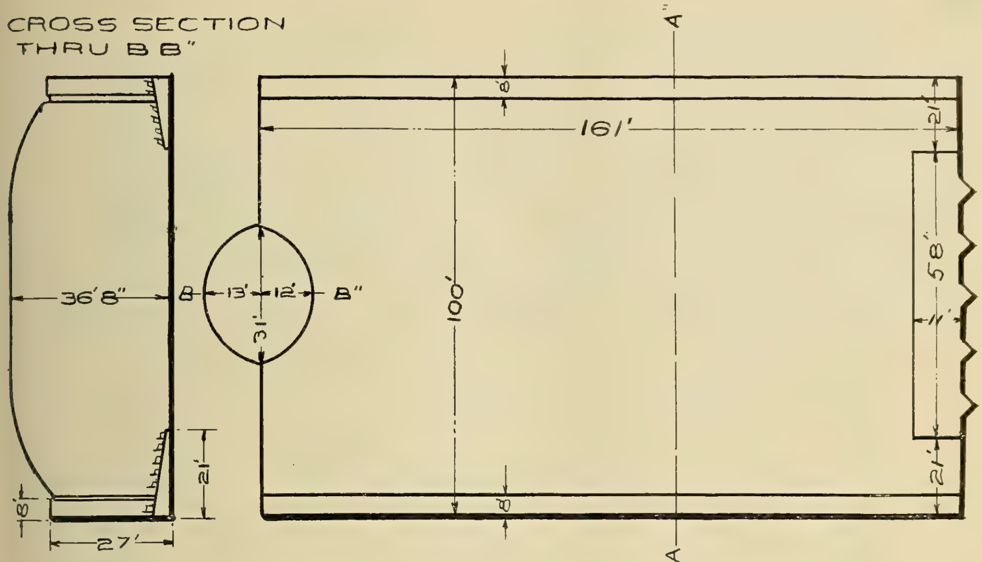
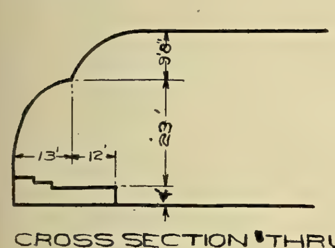



FIG. 2.—FLOOR PLAN.

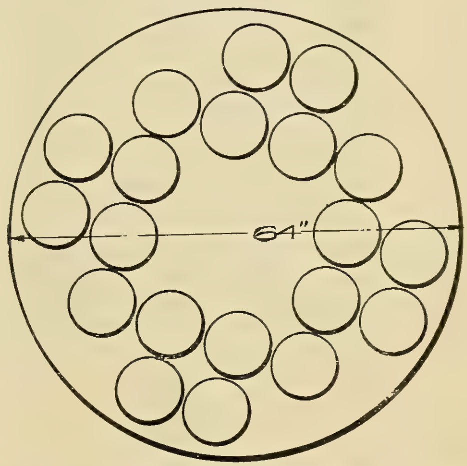


FIG. 3.—ARRANGEMENT OF ONE OF THE INDIRECT UNITS.

obtained were all and even more than anticipated. The charm of the illumination can only be realized by those who spend some time under its soothing influence. In fact, the two above mentioned installations are now in a class by themselves, and there are probably no auditoriums in this or in any other country, for that matter, illuminated in as satisfactory a manner.

The data covering this installation are as follows:

Size of room, 100 x 161 ft.; area of room, 16,100 sq. ft.; ceiling, 36 ft. 8 in. at center; ceiling, 27 ft. at sides.

Curvature of ceiling as shown in photograph and plan.

Six ceiling outlets, each wired for carrying capacity of 2400 watts.

Each outlet is placed in the center of a rectangle approximately 50 x 53 ft.

Each contains twenty 100-watt clear bulb Mazda lamps, in E-100 diffusing type of reflectors, hung 72 in. from the ceiling.

Total wattage, 12,000; watts per square foot, 0.75; watts per lumen, 0.37; average foot-candles throughout entire room, 2.

It will be noted that but 0.75 watt per square foot is used, giving an illumination that makes it possible to read small print in any portion of the room.

Each group of the twenty diffusing type of reflectors were contained on a skeleton fixture, as shown in sketch, and this encased in an artistic composition bowl 64 inches in diameter, shown in the illustration. As is known, such composition fixtures can be made of a style and given a finish to harmonize with the decorations in any interior.

"Signs"

By Albert Jackson Marshall.

The advances which have been made in the design, construction and operation of electrical signs in the last few years has been truly marvelous. Effects have been produced which reflect mechanical ingenuity approaching perfection. Where effects representing life motion have been striven for, results have been obtained which have been wonderfully true, when one considers the implements with which the designers had to work. However, the art is susceptible to considerable refinements, some of which are evident to the casual observer.

As a case in point, there recently was erected on the top of a hotel in New York City a mammoth sign weighing a great many tons, a portion of which represents a chariot race where, through the agency of mechanically controlled "flashers" operating incandescent electric lamps, the horses, urged on by the drivers, appear to be madly plunging around the arena. For stupendousness of size and cleverness of design and execution this sign is well worthy of any and all complimentary remarks that have been tendered. While the idea of plunging, galloping horses would appear as a most excellent subject for attracting attention and thus serving the commercial purpose for which the sign was erected, yet when one's attention is arrested there appears to be "something" lacking, and those with an analytical turn of mind are inclined to try and discover what this "something" is. After having studied the sign on a number of occasions, I am inclined to feel that that "something" is the lack of noise, the feeling of excitement which naturally would attend an event of such character. As one looks upon the sign everything is noiseless, as smooth running as well oiled mechanical apparatus can produce, whereas, if the spirit of the crowd which would view a spectacle of this kind was evident, the purpose would be better served, and the sign would more nearly represent the painting from which it was taken, where the artist, through his oils, was able to create the feeling of "life."

Aside from this lack of "expression" there is a mechanical feature of the sign which to my mind could be improved, which holds good for other signs using similar effects. The outline of the horses, with the exception of the legs, consists of incandescent electric lamps which burn without interruption while the sign is operating. These lamps, consequently, are burning at their rated voltage producing a normal intensity and color, whereas, the lamps which are used for outlining the legs of the horses, by being operated intermittently, do not have an opportunity of reaching their normal intensity and color, causing the lamps to appear as if they were being burned under voltage, producing a color value reddish in comparison with the normally operated lamps which gives one the impression that the legs of the animals are of a different color than their bodies, and thus partly destroying the illusion. The thought has occurred to me that if the lamps, which would be operated intermittently, would be of a lower voltage than the constant burning lamps, both using same line voltage, the current would be able in the short space of time between the flashes to bring the lamps up to their proper state of incandescence, and thus have all lamps going to make up the horses appear of the same color value and intensity.

These criticisms, which I have intended to be of the constructive order, are tendered to those responsible for this, the most wonderful sign of our times, for what value they may be worth.

FIG. I.—INTERIOR OF HOME OF A SOUTH AMERICAN MILLIONAIRE, GUAYAQUIL, ECUADOR.

Lighting in Faraway Lands

The patriotic American now has one more cause for pride in his country: it is the land of illuminating engineering. Just as Americans on the average live better than any other people with regard to food, so they have better artificial light. Some foreign cities may have better public lighting in their principal cities; but take an average of all lighting, from the homes of the poor to the mansions of the rich, and from the country store to the metropolitan palaces of trade, America will, without doubt, easily hold first place among the nations of the earth.

But while our average is high, we must not deceive ourselves by imagining that we surpass all others in all cases. Money, or money's worth, will purchase the luxuries of life anywhere; and the rich have always been with us, as well as the poor. So we may expect to find cases of the lavish use of light, and gorgeous lighting fixtures, in the remote corners of the earth to which civilization has penetrated. It will

be interesting to step into the palaces of wealth in widely different parts of the globe and see how they are illuminated.

In Fig. 1 we see the interior of a millionaire's home in Guayaquil, Ecuador. The illumination is decidedly modern. An electric chandelier of Art Nouveau tendency and fitted with richly cut globes, remind us that electricity has climbed the Andes and flourishes under equatorial suns as well as in the frozen north.

We now journey a short distance to the north of the equator, and find ourselves in the ladies' drawing room of the palatial Castle of Chapultepec, Mexico (Fig. 2). Here we find an elaborate and beautiful chandelier, with frosted electric lamps in place of candles. An illuminating engineer might find technical faults, but surely there must be light in abundance, and no distressing glare of bare lamps—which is more than can be said of mnay an installation in our own government buildings.

From these countries of the New World we now go to their antipodes, and reach a nation that was hoary with antiquity when our ancestors were yet howling savages. Fig. 3 shows the reception room of

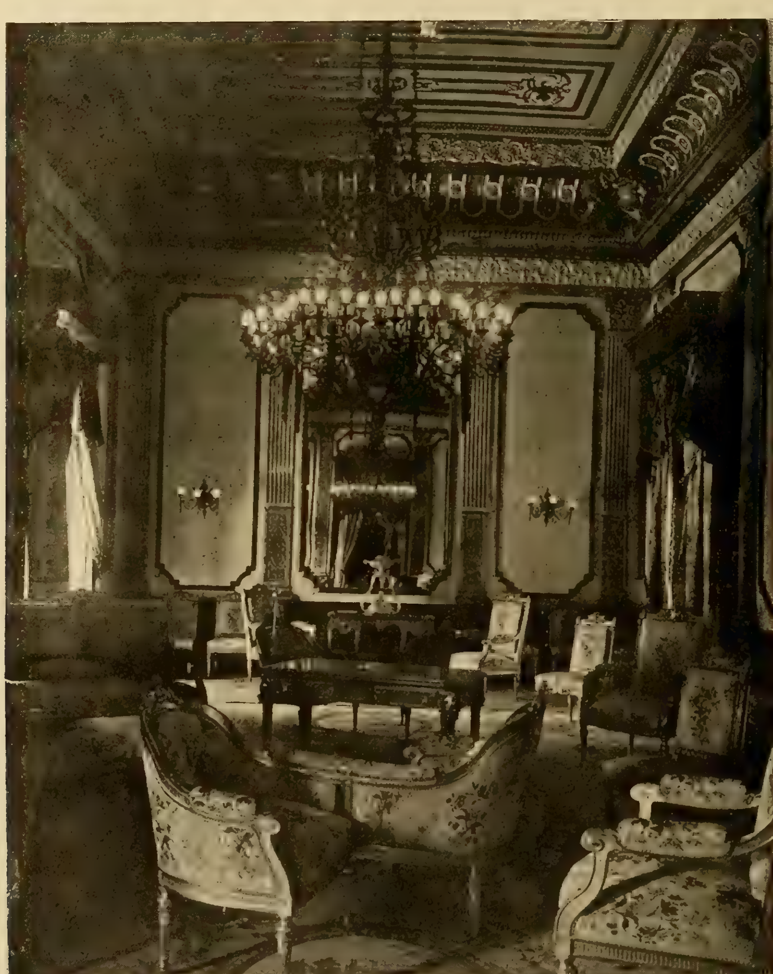


FIG. 2.—DRAWING ROOM. CASTLE OF CHAPULTEPEC, MEXICO.

FIG. 3.—RECEPTION ROOM OF A PASHA, DAMASCUS, SYRIA.

a pasha of Damascus, Syria. For an instant consider only the infinite details and gorgeous design of the distinctly Oriental decorations, and ask yourself what sort of a lighting fixture you would select to "harmonize" with these surroundings. What do you generally see in American rooms "done" in the Oriental style? Generally some absurd contraption of "hammered" and perforated brass, bedecked with colored glass jewels, and about as useful as a lighting device as it would be for a cook stove. Our friend the Pasha has no such mistaken notions of "harmony." He hangs up one of those splendid crystal chandeliers which become any room because they are in harmony with the purpose of a chandelier—*illumination*. Apparently also he uses a good American oil lamp when he does not care to have the candles lighted, or when he wants a good reading light.

The wealth of India! Coveted by many others before and since Columbus! Rich in pomp and splendor, in gold and jewels. What could be more lavish than this room the house of a Nawah of Hyderabad shown in Fig. 4? And yet it is

neither gaudy nor outlandish. The lighting embraces as many different styles of fixtures as there are variations in the furniture. The central piece is a magnificent chandelier bearing hundreds of the little oil lamps that have been in use from time immemorial, and are as characteristic of the Orient as the odor of sandal wood. On either side of this an exquisite example of the crystal "lustre," for use with candles. Simple chandeliers supporting modern kerosene lamps are added for more purely utilitarian purposes. Table lamps, and brackets with crystal decorations complete the means of illumination.

Imagine all these lights burning; would it not be a scene to dazzle the fancy rather than the eyes?

FIG. 4.—ROOM IN HOUSE OF NAWAH OF HYDERABAD, INDIA.

Fixtures and Accessories

Illuminating Glassware: Its Relation to Lighting Fixtures

By E. Leavenworth Elliott.

CHAPTER II.

The appearance of glassware, both by reflected and transmitted light, is naturally determined by the methods used for producing diffusion and reflection. Perfectly clear crystal glass is occasionally used for decorative effect, but since the art in fixture construction is always in the nature of applied or decorative art and cannot, therefore, be its own reason for existence, there is very little legitimate use for clear glass, which seldom has any real or apparent use in connection with modern light-sources. About the only case of the kind is for fixtures of the lantern type, in which clear glass is used in connection with a metal framework. Lanterns for interior use, however, are of very questionable propriety, the purpose of a lantern being to protect a light-source from the weather for out-of-door use.

An essential quality of all glassware is its color; and this applies quite as much to what is commonly considered perfectly transparent, or colorless, glass as to that which is distinctly colored. This problem of color is one of the most difficult which confronts the glass maker. While a single piece of glass of ordinary thickness will appear perfectly transparent and colorless, if looked into edgewise, so as to view a considerable thickness, the color will invariably appear, the shade varying from green to straw color, or through tints of amethyst. The former is technically known as " low " colored, and the latter as " high " colored glass. While the color does not, except in very cheap grades of glass, show in individual pieces, it may very readily appear when different pieces are placed side by side, so that some care is necessary in selecting glass that is to appear on the same fixture to see that it is of the same color.

" Frosted glass " is a popular phrase covering all methods of roughening the surface of crystal glass. The chief methods for such roughening are by sand blasting and etching with hydrofluoric acid or fluorides. Sand blasting produces a much rougher texture of grain, the fineness depending upon the fineness of the sand used. The coarser the grain the less the coefficients of both absorption and diffusion. Sand blasting also is occasionally used on translucent glass to give it a mat surface. As the sand cuts through the outer glass sand blasted glass is very much weaker, both to mechanical shock and to changes of temperature, than the glass in its natural state.

Etching is capable of giving a great variety of effects, both of transmitted and reflected light, as is shown in the various patterns and designs produced by this process. As it produces a very much finer grain it gives somewhat higher coefficients of diffusion and absorption, and weakens the glass somewhat less than sand blasting.

The difficulties of keeping roughened glassware clean are sufficiently familiar to need no discussion here. Generally speaking, the finely etched surfaces give

quite as much trouble in this respect as the coarser, for the reason that soil shows plainer on the finer surfaces.

The general result upon the distribution of light of a roughened glass surface is to bring the curve more nearly to uniformity. Thus, a distribution like that of an incandescent electric lamp will be materially lessened at the horizontal and somewhat increased at the vertical above and below. Neither sand blasting nor etching changes the color of the original light-source.

Translucent glass consists of a matrix of crystal in which there are distributed white opaque particles, and is of two different kinds—that in which the particles are invisible, which constitutes the ordinary "opal" or opalescent glass, frequently called "porcelain," and that in which visibly large particles of white substances are scattered through the matrix, which gives the glass an alabaster appearance by both direct and reflected light. Glass of this description has come upon the market comparatively recently under the trade name of "Alba."

Opal and opalescent glass, while white as generally understood, varies in color, especially by transmitted light, according to the method of manufacture, that in which phosphates are used giving an orange tint, while that produced from cryolite is of a skimmed-milk blue tint. Other methods produce an opalescence that is practically pure white. Glass of the first kind is useful in correcting the color of light-sources that have an excess of blue, such as the carbon arc. This property can likewise be utilized to mellow the tint of tungsten and other high efficiency electric lamps. Pure white opal is especially desirable for reflecting glassware. The peculiarly shiny or glassy surface can be readily removed by light acid etching, which imparts a peculiar satiny gloss that is much more artistic than the naturally glazed surface. The single objection to this is, of course, the increased difficulties of cleaning.

Attempts have been made to distinguish different degrees of translucency in glass of this order by giving it different names, as "alabaster," "opalescent," "opal," etc., none of which, however, is even an approach to accuracy. Very lightly opalesced glass is made either by forming a very thin layer of opal over a body of crystal glass, or by using a phosphate mixture, which is opalesced by reheating.

An opalescent glass showing distinct orange by transmitted light and finished on the inner surface with a special etching is sold under the trade name "Opalux." The reflectors are pressed in a design giving different thicknesses to the glass, thereby varying the translucency accordingly. This ware has a somewhat shell-like appearance by reflected light and a soft orange tint by transmitted light.

Among the pure white opal glassware, especially that sold in the form of reflectors, the brands known as "Pheno," "Gletieco" and "Camia" are excellent examples.

Dense opal glass forms an exceedingly efficient reflector, being excelled only by the best silvered blown glass in this respect. Such glass of necessity gives very little transmitted light, and may more properly be classed with opaque reflectors than with translucent.

Ribbed or corrugated glassware may be divided into two classes—that in which the ribs or corrugations are for purely decorative purposes, and that in which they are given a prismatic or lenticular form for definite purposes of distribution. Transmitting glassware of the former kind has very little to recommend it. It usually has a high coefficient of absorption and a very low coefficient of diffusion, and, especially when lighted from within, shows its plebian origin, which is the glass press. The common pressed crystal glass globe may be rightly classed with furniture decorated with stamped carving. The most that can be said of such globes is that they are cheap. These remarks, however, do not apply to pressed translucent glass. The varying thickness in this case shows the design by transmitted light and may be made to give really beautiful effects. Of all transmitting globes none is so exquisite in its delicacy and softness as real alabaster, and some of the recent forms of translucent glass, such as Alba, give wonderfully close simulations of the natural product.

Prismatic glass is used for both the purpose of reflection and transmission, and possesses a combination of properties which put it in a class by itself. When designed

for reflection alone it is highly efficient, approximating silvered blown glass. It acts like a mirror surface, which permits of the reflectors being so shaped as to give a certain predetermined distribution of light within close limits. As it transmits a portion of the light, it acts like translucent glass, so that it possesses the novel combination of both the silvered mirror reflector and the translucent glass shade. Its coefficient of diffusion is low, the transmitted light being shown in streaks which have a comparatively high brilliancy. To secure a higher coefficient of diffusion reflectors of this kind are made with one surface etched. This, of course, is a compromise between reflection and transmission, decreasing the latter and increasing the former, and also increasing the coefficient of absorption.

Prismatic transmitting globes act to a certain extent like reflectors in changing the distribution of the light, and as diffusers in breaking up the radiant into a large number of small points. It differs from frosted and translucent glass in this respect, in that the points are of clearly visible size, instead of an invisibly fine kind. The actual coefficient of diffusion of the glass is, therefore, much less than appears on first observation, the points of lights in themselves being brilliant.

In order to obviate this difficulty and to increase the co-efficient of diffusion, the expedient of lightly frosting or enameling the outer surface of prismatic reflectors has been resorted to. This, of course, is a compromise between the efficiency produced by total reflection and the higher absorption resulting from frosted and opal glass. The denser the coating in such cases the greater the interference with reflection and consequent loss in efficiency. It is a matter of choice in using such globes as to which is of the greater importance, diffusion or reflection.

A Reading Lamp

By S. H. M. Agens.

I believe, for the best results in reading by artificial light, in the house one should have illumination on his reading page primarily emanating from a single light source. I believe that this light source should not be naked, but should be properly surrounded by the best diffusing medium obtainable.

The advantages of a constant, single burning, light source as they appear to me are important. First, there is only one unit to buy and consider in selection; second, the first cost is apt to be low, considering the results obtained; third, the maintenance is surely to be at less cost and dealt with with more certainty; fourth, the possibility of streaks and shadows—a very important matter—is eliminated; fifth, a constant and uniform color is obtained; sixth, the mind can be more easily concentrated on the subject matter at hand, and, all other things being equal, the highest degree of economy of attention is obtained.

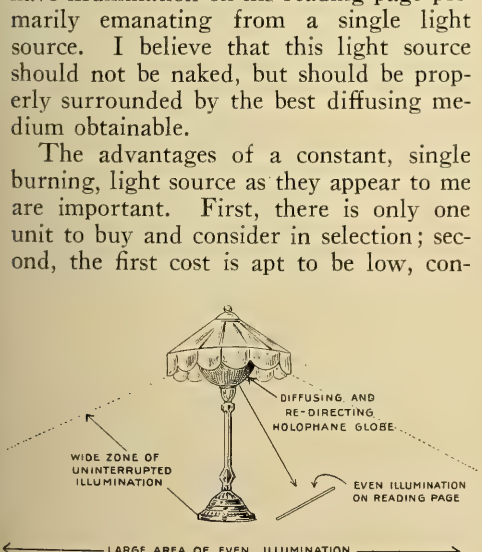


FIG. I.

Perhaps it would have been better at the start to have told just what are the "best results," or rather attempt to indicate what one should have in the matter of illumination when one reads. I refer to the illumination on the reading page. I suppose sufficient intensity should come first. "That lamp doesn't give enough light," is a common expression frequently heard. This simply means that the reading page is dull and the eyes become strained when applied to it. Streaks, striations and shadows or even the faintest suggestions of them should have no place

FIG. 2.

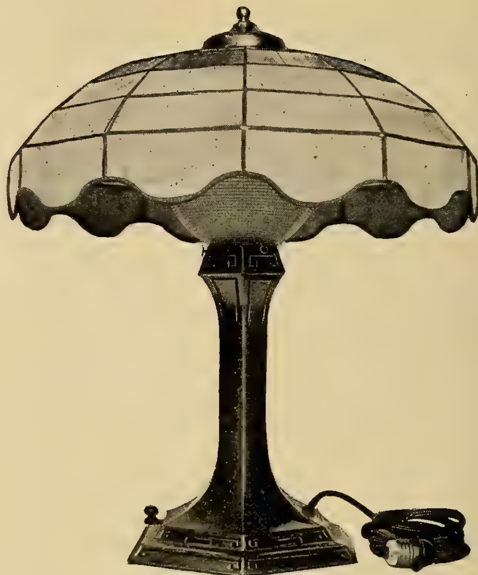


FIG. 3.

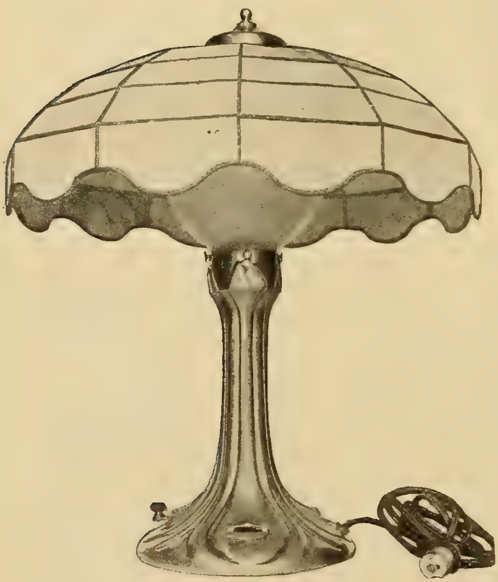


FIG. 4.

FIG. 5.

on the reading page. The attention is very easily distracted by these things. It does not make much difference whether they are moving or not. A graceful and healthful sitting posture is of great moment if one does a great deal of reading. The light should be so placed that it illuminates the reading page when it is held in a position with every degree of ease and comfort. The reading page should be illuminated with a light of a proper color. It is generally conceded that the quality of light as emitted from the Mazda lamp is, for reading purposes, the most satisfactory and generally acceptable.

Fig. 1 is an outline sketch of an electric

FIG. 6.

FIG. 7.

portable reading lamp which has a single light source and has only lately been put on the market. Some idea can be had of its construction and purpose from the notations as given.

Numerically given, the claims for the lamp or its points of excellence are:

(1) A scientifically designed electric portable reading lamp.

(2) For a light source, preferably a Mazda lamp is used, thus insuring economy of operation.

(3) Inasmuch as a brilliant light source should never be exposed to the naked eye, a diffusing and redirecting surrounding Holophane globe is used.

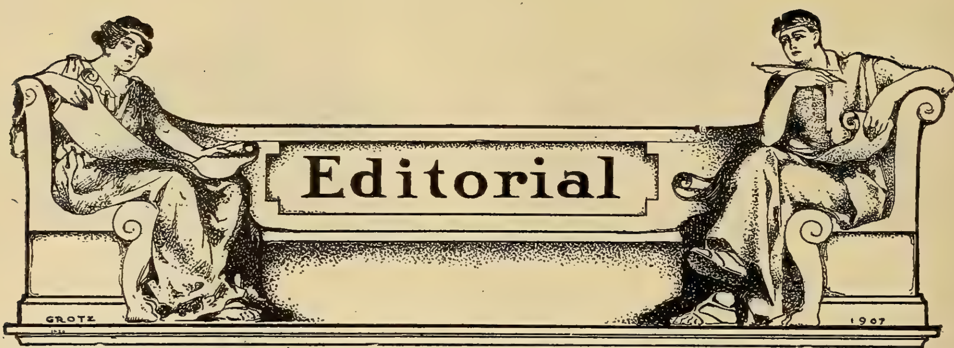
(4) The base or column of the portable lamp is of such height, and the art dome is so placed in relation to the diffusing and redirecting Holophane globe, that a wide reading zone of hygienic uninterrupted illumination is obtained.

(5) In the base of the lamp there is a regulating switch. By moving the switch handle, the illumination is diminished or increased at will, thus not only obtaining different intensities but various qualities of light and economy.

With these characteristics this lamp is justly attracting a great deal of attention in the lighting field, and doubtless will prove to be one of the most useful lighting units since the advent of illuminating engineering.

The artistic side has not been forgotten nor neglected, as can be seen from the cuts of lamps as shown. Fig. 2 is a large lamp of a height of 32 inches, with an art glass dome of 20 inches in diameter. With lamps as Fig. 2 100-watt plain Mazda lamps are used. Figs. 3, 4 and 5 are all of the same height—viz., 21 inches—and the domes are in good proportion with a diameter of 18 inches. The bases of these designs vary to a greater extent than may be supposed. Fig. 3 is hexagonal and the lines, though severe, are harmonious and consistent. Fig. 4 is a conventionalized flower effect. Fig. 5 is plain and dignified. The domes as shown in these three illustrations are the same, although many others of slightly different patterns are to be had. The 40-watt Mazda lamp produces in these designs adequate illumination.

The base, Figs. 6 and 7, is particularly attractive. The standard finish is green bronze. This with the green of the No. 2924 20-inch dome, relieved by the shaded amber background, makes a unit pleasing to the most fastidious tastes. The No. 2923 dome is lighter in color, the glass being a beautiful blending of amber tints with enough green to offer a good contrast.



The Menace of the Dazzling Light

An Element of Danger in Modern Light-Sources That Should Be Corrected

The annoyance of dazzling light-sources, such as unshaded arcs and the modern tungsten lamp, in street lighting, has been long recognized. The wonder is that the nuisance has been tolerated in this country so long. In Europe they do some things much better, and street lighting is one of them; the atrocity of the unshaded arc was never tolerated there.

Fatalities Due to Dazzling Lights.

The automobile has introduced a new factor in street traffic, and, as it has not only come to stay but is unquestionably bound to increase rapidly for many years to come, a consideration of the necessities of automobile traffic is an important factor in all considerations pertaining to streets and highways. A case was recently reported where an automobile had a rear-end collision with a wagon ahead, throwing the driver some 75 ft. to his death, the chauffeur claiming that he could not see ahead of him on account of being blinded by an electric lamp. Of course, the chauffeur should have recognized the fact that he could not see beyond this dazzling light source, and kept his speed down to a safe rate; but the fact remains, nevertheless, that the dazzling light was responsible for the accident.

Another accident in the same city, and occurring at nearly the same time, also cost a life. A trolley car passing one of the parks ran over a pedestrian who happened to be crossing in the shadow of a tree, the motorman's eyes being so dazzled by the bright spot of illumination immediately in front of him that he could not discern objects in the shadow ahead.

Unshaded Street Lamps Must Go.

The time has now come when unshaded or bare light-sources should not be tolerated, even in exterior illumination. It has been shown time and again that, so far as actual vision is concerned, there is a decided gain by equipping a light-source with a diffusing globe, or otherwise hiding its direct rays from the eye. Simply because there may be some additional expense in maintaining the necessary diffusing or shading apparatus, and that there is actually some absorption of light, is no longer a sufficient excuse for the dangerous annoyance of unshaded light-sources.

In a general way, the fact has been known for a long time that, in point of actual vision, the loss of light occasioned by diffusing globes is far more than compensated for by the increase in physiological effect. This important point was never scientifically investigated, however, until the subject was taken up by Mr. Sweet, a report of whose investigations is given in another section of this issue. These re-

sults will astonish even those who have been familiar with the general effect, in the magnitude of loss of visual perception occasioned by glare.

A great deal of legislation has been proposed and many legal regulations enacted governing automobile traffic. Streets and highways are made for the use of the people, with whatever means of locomotion may be most convenient and practical; and, while such regulations for different sorts of traffic are necessary in order to protect the rights of all, the people engaged in such traffic have a perfect right to demand that the streets and highways themselves shall be equipped in the best possible manner for their use.

Streets Must Be Made as Safe as Possible.

Some clever official in a Western city conceived a brilliant and simple plan for preventing automobiles from speeding in its suburban streets. He constructed transverse raised ridges across the streets at frequent intervals, like those on country roads known as "thank-you-ma'ms." If these were run over at what was considered undue speed, the jar on the automobile would be such as to induce the driver to keep his speed down to the desired rate. The injuring of a machine by this device was the occasion of a suit brought against the city for damages, with a verdict for the plaintiff. As a result the street was at once leveled to its original condition, which illustrates the point that we are making—namely, that the streets are made for use by everybody, and those who use them have a right to demand every condition of safety and convenience that it is practicable to provide.

Before leaving this subject, however, a word as to the nuisance of the average automobile headlights will not be amiss. These are generally search-lights of no mean proportions, and to look one in the face is to dazzle the eyes to practical blindness so far as vision at the time is concerned. The fault is the more inexcusable because it is unnecessary. It would be a very simple matter to construct the head-lights so that they would throw their light on the pavement or roadway equally well without throwing it up where it would strike the eyes of others using the highway.

Light and the Textile Industries

The textile industries rank on about an even basis with the iron and steel industry in respect to magnitude. The latest statistics put the former slightly in the lead, and appreciably so as to the number of employees. There is no other large industry in which the question of light is so important, for in no other does the work deal with such fine details. Both the quality and quantity of the output are therefore more largely dependent upon the light which the operatives have to work by than in the case of any other industry. There is a decided tendency to deal with the lighting problem on accurate scientific lines. Any systematic study of the problem must involve more than a mere technical consideration of the illumination if the final results sought for are to be obtained. The real test of a lighting installation is not in ascertaining how many watts per square foot are used to produce a certain number of foot-candles on a chosen test plane, although such data is useful, but in determining the efficiency of the operatives working under the illumination. The cost of producing the light is a mere trifle as compared with the results which it produces upon the efficiency of labor. The difference between one and two watts per square foot of floor area would not equal the wages of a single operative in nine cases out of ten, to say nothing of the effect upon the quality of the goods produced. Efficiency from the engineering standpoint is so secondary to efficiency from the manufacturing standpoint that it need have no place in the calculations until the question of operative efficiency has been definitely settled; then, of course, the illuminating engineer will see that there is no unnecessary waste.

It is a rather curious fact that the three general branches of the textile industry—viz., cotton, wool and silk—are in a depressed state at the present time apparently from three independent causes. It seems to be a period of "waiting for something to turn up." This slack period affords the best possible opportunity for the careful investigation of various lighting methods, and the installation of such im-

provements as may be found profitable from the operative standpoint. This statement will probably meet with general objection, for the reason that it is human nature to hold on to money when income falls off, no matter how inherently strong the concern may be. This human trait is shown conclusively in the conspicuous fact that building and improvements are always carried out in the periods of greatest business activity, and consequently at top-notch prices. When labor and materials become cheap improvement ceases; and this condition multiplies itself by the effect alternately acting as the cause.

It is only the few who, possessed of faith in the general prosperity of our country, and with the certain knowledge that no matter how bad times may be at present, they will be good again at some not remote time in the future, take advantage of business lulls to make improvements for the future. That good times in the textile industries are bound to come, and at no very distant date, is as sure as that rain will come after a drought. No matter what the present conditions are, they are either going to change or they are going to be reckoned with as they exist, and business resumed. This has always been the case, and always will be.

We therefore repeat that the present slack time in the textile industries affords a particularly auspicious opportunity for working out the very important problem of artificial illumination. When the revival comes, and orders are piled up and every facility and energy is strained to the utmost in filling them, it will be no time for changes and experiments, with the result that the production will be made at an appreciably higher cost than it would be were the question of lighting solved now and the installations brought up to date while there is comparative leisure.

The Old and the New

To predict the extinction of any particular type of light-source on account of the appearance of a new type possessing evident advantages over the old is a rash prophecy. We are yet immeasurably far from perfection, either in moral or material affairs, and until that happy condition is attained we shall still find uses for the old along with the new. "There is no great loss without some small gain," says the old proverb; and conversely, there is no great gain without some small loss. The steam and electric railroad has not entirely supplanted the stagecoach; the old time fireplace still warms and cheers the heart as no steam radiator possibly can, and there are more candles made to-day than ever before. The Welsbach lamp was a revolutionary discovery, but there are millions of gas flames still in use, and the number is actually increasing. The incandescent electric lamp made an immense stir in the lighting world, but gas, oil and candles have continued to increase in use. And so with all the other light-sources that have blazoned forth their superiority on their first arrival; they have proved valuable additions to our means of illumination, but have found their places side by side with the old.

And this must continue so long as no one light-source possesses *all* the advantages. The candle persists by virtue of its convenience, its mildness, and its associations. The oil lamp is the light of millions because it goes where other illuminants cannot reach. The gas flame needs no attention and possesses the fascination that attaches to the living flame. The carbon filament electric lamp is more rugged and cheaper than the tungsten. The carbon arc is steadier than the flaming arc, and so through the list.

Nor does the rule fail when applied to lighting accessories; candles require candlesticks and chandeliers to-day just the same as they did centuries ago, and shades of cloth and paper flourish in spite of the cheapness and perfection of modern glass. The advent of prismatic shades has unquestionably increased the use of opal and frosted glass. The many and marvelous improvements that have been made within a century in the means of producing and using artificial light are so much added to the facilities for increasing the comfort and happiness of mankind. But let no one imagine that, because he has hit upon some particular method or device that possesses advantages that are novel and important, his invention is going to speedily obliterate all or any previous devices used for the same purpose. We

hear much of the room that there is at the top, all of which is true enough, but there is also room at the bottom, and at all intermediate points.

Making Confusion Worse Confused

The multiplication of light-sources and lighting accessories goes merrily on. New types are being invented, and new forms of old types developed; so that month by month the list of available and useful lighting units and devices increases in number. Back of this development there is the purpose of commercial gain, and accordingly each and every device is exploited with all the skill that can be commanded by the producers. The consumer is being more and more beset by the representatives of these different devices, and he cannot refuse to listen and investigate in justice to his own interests, for if there is any real advantage to be gained by the use of any of these new appliances it behooves him to know exactly what these advantages are.

A number of large users of light when interviewed on this subject had substantially the same story to tell: "Hardly a day passes that there is not a representative in here to show me some new lamp or lighting device, or to give me a dissertation on the peculiar merits of the particular device which he represents. The tungsten lamp, the old familiar carbon lamp, all the variations and styles of arc lamps, new and old, the Nernst and Cooper Hewitt lamps, and the inverted mantle gas all have their story to tell; and every story is a plausible one, backed up with facts and figures. Now, what is a man to do? Whose story is he to believe? If I put in arcs this week I may be persuaded to take them out and put in tungstens next week; and so on through the list. As it is, I am standing pat, and using my old installation, although I have no doubt that it could be replaced with something better. But I don't want something that is simply better when I go to the expense of making a change; I want the very latest and best to be had."

Of course the way out of this dilemma is, at least theoretically, simple and easy. The consumer should refer the whole subject to a competent, *independent* illuminating engineer; and gradually this is being done. Undoubtedly the most serious obstacle in the way of this solution at the present time is the scarcity of illuminating engineers having the qualifications mentioned. The various commercial interests have thus far pretty nearly monopolized the supply, and by offering engineering services "free" they make it difficult for the independent engineer to establish himself. This is a condition which will eventually work itself out. As in other lines, the consumer will sooner or later realize that he cannot look for impartial advice from an illuminating engineer who is under retainer by a manufacturer of lighting supplies. So far as the impartiality of advice is concerned, one may expect to get the same general results from an illuminating engineer who is employed by a manufacturer as he would get from the "physician" employed by a proprietary medicine concern. The diagnosis may possibly be correct, but the prescription will invariably be the particular preparation made by his employer.

It must not be understood for a minute, however, that we consider the employment of illuminating engineers by manufacturing concerns as "unethical." On the contrary, as we have frequently pointed out, the employment of illuminating engineers by such concerns is imperative if they are to give their customers the best service. In point of ethics, the limits of such engineering can be unmistakably drawn. Engineering and salesmanship must be kept absolutely distinct. The salesman may use any argument he sees fit which does not involve misrepresentation of his own goods or unwarranted detraction of those of his competitors, but the salesman must not seek business while acting in the capacity of an illuminating engineer. When the order for goods is actually taken it may be referred to the illuminating engineer employed by the company to see that the goods are so used as to give the best possible results to the buyer. That is his sole prerogative in such cases. He has nothing to do whatever with comparisons, either favorable or unfavorable, of his employer's goods with those of any other maker.

Illuminating engineering as a profession

and science has suffered not a little through the too jealous efforts on the part of commercial concerns to turn it to practical account in securing business. The only legitimate use of an illuminating engineering department in securing business is simply the assurance that it gives to customers that they can receive reliable technical advice as to the use of any purchases they may make. Free engineering is like all other offers of something for nothing—it always has a string to it.

The Life of the Bee

"The bee now builds just as he did in the days of Homer" . . .

—Sidney Smith.

The above statement was part of a quotation which appeared in one of our own advertisements in our last issue. As one of the results of this advertisement we received the following letter:

Arcadia,
Sound Beach, Conn.
August 6, 1910.

The Illuminating Engineer,
New York City.

Dear Sirs:

No, *he* does not. The *he*-bee never did and never will do any building. It is the *she*-bee that worked in the days of Homer and still continues to build cone. The drone, or he-bee, is nothing but a lazy loafer. Please make this correction in Mr. Smith's statement in your advertisement.

Yours very truly,
Edward F. Bigelow.

Mr. Bigelow is the editor of an admirable little magazine called *The Guide to Nature,* and his correction shows two important facts, to wit: He reads the advertising in The Illuminating Engineer, and is thoroughly familiar with those phases of nature which are so entertainingly depicted in his *Guide.* Now that the subject is called to our attention, we may remark further that the point which Mr. Bigelow brings up is highly suggestive, not only to the student of nature but to the student of social and political economy as well. "The life of the bee," as set forth with the exquisite poetic imagination of Maeterlinck, is full of lessons for the student of sociology. We venture the assertion that even brother Bigelow is not quite accurate, or is rather misleading in his statement that it is the shee-bee that does all the work. The working bee, while female anatomically, is in fact sexless or neuter. She has apparently, in the evolution of the race, taken upon herself all of the duties in the social and civil economy of bee life, except the propagation of the species, and naturally this leaves her no time for the duties and pleasures of motherhood; while her male companions, finding that work is not necessary, have inevitably become constitutionally lazy and idle. The neuter she-bees have evidently acquired all of the prerogatives of beedom, including the ballot, and as a consequence have lost all its privileges save that of work. The life of the bee will well repay careful study by a certain element of modern civilization that is making a very loud buzzing at the present time.

Notes and Comments

The Move for Decorative Public Lighting Takes No Vacation

Like Tennyson's brook, the demand for better public lighting might well say: "Men may come and men may go, but I go on forever." Even with the unusually hot summer, and the increasing tendency of business to take a rest during the heated term, there has been no evidence of even temporary lassitude in the movement for better lighting.

Most cities are now indulging in some sort of a festival in the fall, either in the shape of an "Old Home-coming," or a carnival, or some other manner of merry-making; and so soon as active preparations are begun for the celebration the subject of illumination comes uppermost. In planning this at least four different underlying motives may be detected: to produce a gorgeous spectacle that will attract as many people as possible; to surpass anything that the city has done before; to eclipse the efforts of its nearest

competitor; and to make such an impression upon the citizens that at least a part of the display may be made permanent.

Buffalo, Atlanta, St. Paul, Grand Rapids and Macon are planning displays of this kind.

Meanwhile, the activity of commercial clubs and similar civic organizations goes on unabated. La Crosse, Birmingham, Racine and Minneapolis are active centers of such agitation at the present time. The extract from the editorial in the La Crosse *Tribune* is particularly worthy of note.

The only limit to this movement for better lighting is the exhaustion of opportunity, and that at present seems about as remote as the exhaustion of our coal fields. The putting up of a modern installation along a few squares on a business street is a good beginning and well worth all the effort it costs, but it comes no nearer to being the limit of possibilities in better public lighting than does the foundation come to being a completed house. It will be time enough for citizens and civic bodies to rest upon their oars in this matter when every one of their streets and alley-ways is lighted up to the fullest extent of the possibilities afforded by modern light-sources and the limit of expenditure that can be profitably made in this direction.

It is a splendid evidence of civic pride and public spirit that so many of these installations are started by private enterprise; that they must eventually be turned over to public support is inevitable, and that movements looking to this end have been set on foot in several cities is only the natural order of events. Public lighting is a public benefit, and should be borne by the public; but let the object lesson in local patriotism be continued until every city and town shall be lighted in a manner befitting a twentieth century American commonwealth.

LA CROSSE, WIS.—Sentiment in favor of the proposal to substitute lighting standards for arc lamps in the business section of La Crosse is rapidly crystallizing. So far as we have been able to learn, and we have made diligent inquiry, the business men of the civic center section are practically unanimous for it. Justification for this position on the part of citizens is found in the fact that not a single city that has adopted the system would, under any conditions, go back to arc lamp lighting. This has been ascertained by correspondence with city clerks over a large section, and sufficient benefits to justify the change are recorded in each answer in addition to one item which has the widest importance of all. This item is the advertising value of the change. It not only gives the maximum efficiency in street lighting, but it beautifies as well, and travelers cannot visit a city having standard lighting without being impressed and spreading that impression in their travels. Of every municipality with which the La Crosse committee has had correspondence the question has been asked: "Does standard lighting pay as a municipal advertising?" And the answer has been, without exception: "Yes."—*Tribune.*

BUFFALO.—Great enthusiasm is being shown in the new lighting project of the Genesee Carnival Association, which is to be made a permanent feature. George P. Urban, chairman of the illumination commiteee, was directed to contract for eighty standards, to be 13½ feet high, upon which five large Tungsten lights are to be placed. This permanent improvement is to cost $4,000, the entire expense to be paid by the taxpayers and business men of the street. Permission to erect the standards and have the necessary wires connected and to remove the old arc lights has been granted by the Common Council during the past week. In addition to having about ten times more light than is had at the present time on Genesee Street, the cost to the city will be considerably less per light than under the present system, the cost of the arc lights on each standard for current being but $37.50 per annum.—Courier.

MACON, GA.—The contract for lighting the midway will be let in a few days. The new arrangement of having large tungsten lamps every few feet instead of several thousand small incandescents has met with popular approval. It will not only save considerable money for the fair association, but it will add greatly to the attractiveness of the midway.—*Telegraph.*

ATLANTA.—The city is to be asked to lend a helping hand in the movement to install an ornamental system of lighting for Peachtree, Whitehall, Mitchell and other downtown streets. At the next council meeting the entertainment committee which is arranging for the comfort and pleasure of the Sovereign Grand Lodge of Odd Fellows, which meets in Atlanta September 19 to 24, will send a communication to the council urging that body to co-operate with the citizens now working in the interest of the lighting project. This communication will call attention to the great advertisement which will result to the city from properly lighted streets and will request council to take action to

guarantee the installation of the lights.—*Journal.*

While Atlanta merchants and business men are still striving for a "Great White Way," the little city of Macon, down on the banks of the Ocmulgee, has gone ahead, ordered and paid for a similar lighting system which will extend five blocks from the union depot up Cherry street to Cotton avenue, and the merchants of several other business streets are boosting a movement to make additions to the system at once. The "White Way" in Macon will have poles every 50 feet, those on the corners carrying five lights of large candle-power, and those between street corners bearing three lights. Not a single merchant on the streets lighted by the system has failed to sign up for his share of the cost, and the local lighting company has agreed to put up the poles at actual cost. The entire movement has been accomplished by the Chamber of Commerce through Secretary E. H. Hyman, who says that they had little trouble in showing the merchants and property owners that the advantages of the lighting up of the principal streets would be far greater than the initial cost.—*Georgian.*

BIRMINGHAM.—A meeting of the landlords and tenants of property on Second avenue between Twenty-first and Twenty-sixth streets was held yesterday afternoon and the Second Avenue Improvement Association was organized. The purpose of the gathering was to discuss means of lighting this avenue from Twenty-first to Twenty-sixth streets with an electric arcade, similar to the one now on Third avenue and a part of Twentieth street. Of the amount necessary for the work one-third was secured and a committee appointed to secure the additional sum.—*Age.*

OMAHA.—City Electrician Michaelsen returned Monday from Des Moines, where he made an investigation of the street lighting system and other matters connected with his department. Concerning the Des Moines plan of street lighting the city electrician said: "We must admit that Des Moines can show us something in the way of street lighting. The property owners bought the iron posts, which are placed on the curb line, six on each side of a block. There are five globes on each post, and the occupants of the buildings pay for the lighting by contract with the lighting company." Mr. Michaelsen expects to address the Commercial Club on this subject at an early date.—*News.*

ATLANTIC CITY.—In order to determine the best method of lighting the Boardwalk, three companies will be asked to erect demonstrating standards, and Council's Lighting Committee will be able to tell from practical observation which will be most satisfactory. A resolution was introduced into Councils last night to this effect by Chairman Donnelly of the Lighting Committee, and the Atlantic City Electric Company, the Welsbach Gas Lighting Company of America and the Sterling Bronze Company of New York will be asked to participate in the competition. This method will enable the committee to have demonstrations of the three leading municipal lighting methods and a fair estimate of what can be expected from each will be obtainable.—*Press.*

GRAND RAPIDS.—The West Bridge street merchants met at Rauchenberg's, 15 Scribner street, Tuesday afternoon to take up the question of modern city lighting. They had hoped for a proposition from the Grand Rapids Gas Light Company, but no bid was put in. The Muskegon Power Company reported that the expense of stringing seven arches across the street between Front and Turner streets would be $280, and that the expense of eighteen posts, for cluster lights, each cluster having five lamps, would be in the neighborhood of $1300. This expense was considered altogether too great, and it was decided to take the arch light proposition.—*Press.*

RACINE.—There is a desire on the part of scores of citizens to install the Corinthian standard of boulevard lights on the highways of the business districts and do away with the arc lights, and to put in the goose-neck lights on the side streets. It is claimed that these lights would illuminate the streets perfectly and that there would be no more dark places on account of the foliage of shade trees. The Corinthian lights are placed on a column, five in number, and located a distance of 60 feet apart would light the streets brilliantly and the effect would be pleasing.—*Journal.*

ST. PAUL.—More than a quarter of a million individual lights will be used in the illumination of the downtown portion of the city, during the meeting of the League of American Municipalities, the conservation congress and State fair week. Pledges of cooperation from merchants and business houses have assured for St. Paul an illumination which has never been equaled by any American city, declared Secretary F. M. Moore, at the Commercial Club, yesterday.—*Pioneer Press.*

MINNEAPOLIS.—Ornamental street lights installed on the steel arch bridge connecting Hennepin and Central avenues were put into service for the first time last night. The unwonted illumination of that part of the city attracted hundreds of residents of both sides of the river who paused on their way or gathered to admire the marked improvement. The posts, ornate and artistic in their design, lend attractiveness to the scene and show up well in the full radiance of the 100 lights. They make of the bridge and the river a scene such as travelers tell of Venice. The St. Anthony Commercial Club has had charge of the erection of these posts, following out the general scheme of the Publicity Club for ornamental street lamps. Last night saw the fulfillment of the dream of months

held by the men who have pushed the plan to completion. Results last night in the greater safety, security, comfort and pleasure in crossing the bridge more than made up to them for the hard work they had put into the scheme.

The board of tax levy will be requested to provide sufficient funds to maintain the ornamental street lights which have been erected and paid for by the business men of the city. The movement was started by the Publicity Club and the first lights placed on Nicollet avenue and along Seventh street. The merchants paid for the fixtures and one year's maintenance, and last year the city assumed jurisdiction, taking over 84 lights. Since then over 300 more have been installed and the city will be asked to pay for the current consumed by these. It is estimated that the cost will be $21,000 a year. In return the city will be given fixtures worth approximately $40,000.—*Tribune.*

CINCINNATI. — The initiative has been taken in a movement for a "brighter Cincinnati." Upon orders from President Kenan, of the Union Gas & Electric Company, A. E. Alley and Robert Hewson, of the General Electric Company, yesterday installed 75 luminous arc lamps on a circuit which includes the lower part of Gilbert avenue and Reading road, Elsinore avenue, Wood street and parts of a number of other streets. The lights have been "cut" into service as a test, in view of the fact that in less than two years the contract for lighting the streets of the city will expire, and a new contract for a ten-year period be entered into. The indications are that unless something better is invented in the meantime the new contract will provide for the substitution of the present lights by the new arc lights.—*Enquirer.*

SERVING THE GREAT AMERICAN DISH.

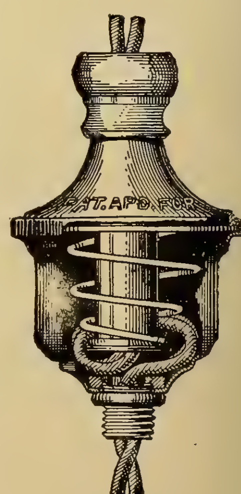
Science and Art Happily Blended in a New Electric Table Lamp

We have before noted in these columns the new electric table lamp which is being sold under the trade name of the G-M Lamp by the Electric Motor & Equipment Company, of Newark, N. J. It is perhaps not generally known what the "G" and "M" stand for. They represent the co-inventors, Messrs. Godinez and Marshall; and every one who has kept at all apace with the movement of illuminating engineering will at once place these two names, which are representative of the scientific and æsthetic sides of the profession. As might be expected, therefore, the lamp which bears their initials is a happy combination of the two foundation elements in what is briefly defined as the science and art of illumination. The decorative features, which are, of course, most conspicuous in the illustration, are the art glass shade and the base or standard.

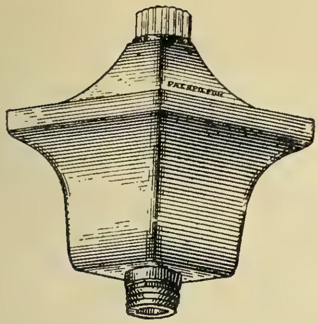
The scientific features are in no wise handicapped by the combination of art; the simple device for increasing or decreasing the quantity and brilliancy of the illumination, the prismatic diffusing screen which cuts off all direct rays from any possible position and the general efficiency of the unit, remain the same. The lamp is a decided credit not only to the inventors but to the science and art which constitute illuminating engineering as well.

A Practical Device for Protecting Tungsten Lamps

While the tungsten lamp represents a revolutionary improvement in lighting by electricity, it nevertheless possesses the single fault of requiring careful handling and protection from sudden jars in order to preserve the filament intact, and many schemes have been proposed for accomplishing this. A thoroughly practical and efficient device of this kind is manufactured under the trade name of "Tungstolet" by the Tungstolet Company, New York. The illustrations show



"TUNGSTOLET."



A NEW FORM OF TUNGSTOLET.

two different forms of this device, which can be used either as a joint in the stem of a chandelier or attached at any point between the ceiling and the lamps. Its neat appearance, good mechanism and adaptability are apparent, and should recommend it to fixture manufacturers and illuminating engineering.

National Electric Lamp Association Bulletins

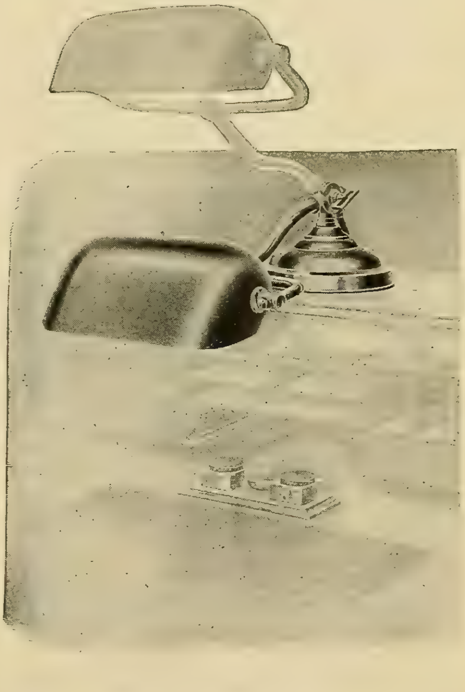
Two bulletins issued by the engineering department of the National Electric Lamp Association, Cleveland, Nos. 9A and 12, deal with the "Cost of Light," by Dr. S. E. Doane, and the "Electric Lighting of Automobiles," respectively. Dr. Doane has given a great deal of careful thought and study to the subject of the proper basis of charging for electric current, and during the past year has embodied the results of his investigations and study in various papers and contributions on the subject, of which this is the latest. This bulletin should be in the reference library of every central station and city engineer, as well as others who are generally interested in the subject.

The "Electric Lighting of Automobiles" is perhaps the most complete digest of the subject that has appeared in a single paper, and gives valuable information on the subject.

Something Good in Desk Lamps

It is pretty generally admitted that the only thoroughly satisfactory way of lighting a desk is with an individual portable lamp, and many have been the attempts to produce a lamp for this purpose that would meet all the conditions. The evident trouble with most of such devices has been that the controlling motive in their design was to see how cheap they could be made rather than how good. Small tubing, flimsy stampings, and cheap castings have been put together into the semblance of something permanent, but in this, as in all other similar cases, use invariably discloses the weakness.

The "Emeralite" lamp is an exception to this rule. Even an examination of the picture will show that in both design and workmanship the lamp is constructed in the very best manner possible. The parts are well proportioned, strong, correct mechanically as well as artistically, giving to the complete apparatus both the appearance and the reality of substantial worth. The shade is not an adaptation, but a form



ONE OF THE NEW EMERALITE DESK UNITS.

especially suited to the purpose, with white opal glass on the inside, which is conceded to be the best of all diffusing reflectors, and green on the outside, equally conceded to be the most restful tint to the eyes.

The "Emeralite" desk lamp is a fit

companion to a modern desk and a modern business man. It can be instantly moved to any position and adjusted so as to give exactly the illumination on the desk that may be desired, so that every one can suit his own personal fancy as to the kind of illumination he will use. It is sold by H. G. McFaddin & Co., New York.

Announcements

Mechanics' Building is especially adapted for an exhibition of this character, and is the best and most widely known show building in this part of the country.

The annual exhibition of the National Commercial Gas Association for 1910 will be held in connection with the annual convention, in Mechanics' Building, Boston, December 5 to 13, 1910.

The Association of Railway Electrical Engineers will hold their second annual convention at the La Salle Hotel, in Chicago, September 27, 28, 29 and 30, inclusive, and arrangements for this convention are being made by the Electric Supply Manufacturers' Association. The top floor of the La Salle Hotel has been reserved for exhibits, and most of the prominent electrical manufacturers interested in selling steam railroads will exhibit at this time.

The convention of the Pennsylvania Electric Association, to be held at Glen Summit Springs Hotel, Glen Summit Springs, Pa., September 14, 15 and 16, will be made as attractive as possible from every point of view. The location, 2500 feet above the sea level, is ideal, is easily accessible, being on the main line of the Lehigh Valley Railroad; all trains stop at the hotel. The hotel rates will be $3 daily, rooms with bath $4 daily.

The Entertainment Committee is arranging a programme which should make the convention pleasing to the ladies and provide amusement for all.

There is an opportunity for boating, bathing, baseball, tennis, bowling, shuffleboard, pool, billiards, driving and automobiling. The scenery is beautiful; the air and water the purest in the State.

The Programme Committee is arranging for the writing of papers on the following subjects:

Steam Heating.

Advantageous Points in Station Operation.

New Types of Lamps from the Operating Standpoint.

Operation of Electrical Vehicles.

Domestic Appliances.

Investment Justified by Smaller Companies for Securing Power Business.

Rates.

These papers are being prepared from a practical standpoint and will be arranged so that members who cannot attend all sessions may be able to select one day to advantage.

The annual meeting of the American Gas Institute will be held at headquarters, 29 West Thirty-ninth street, New York, beginning Wednesday, October 19. Hotel headquarters will be at Hotel Astor, Times square.

The Committee on Arrangements has not entirely completed its programme, but has plans for a banquet Thursday evening at the Hotel Astor, a theater party on Wednesday evening, for members and accompanying ladies, and a steamer excursion on Friday.

It is planned to have a morning and afternoon session Wednesday and Thursday, with lunch served in the Engineering Societies Building between sessions and to devote Friday to the excursion.

The Technical Committee announces that it has 16 very interesting papers to be presented, covering technical, commercial and general subjects.

Personal

Mr. H. M. Hirschberg, president of the Excello Arc Lamp Company, who sailed abroad in June, has returned home after his annual visit to the lamp works brimming over with enthusiasm, as usual, over the Excello arc lamp.

Proceedings of Technical Societies

International Acetylene Association Meeting, Chicago

REPORTED BY A. CRESSY MORRISON.

The thirteenth annual meeting of the International Acetylene Association was held in Chicago, August 3, 4 and 5, at the Congress Hotel Annex. Elaborate arrangements had been made for the comfort of the visiting acetylenists, and the meetings were held in the room of Francis I. The attendance was considerably over 100, which exceeds the record of this association, and speaks exceedingly well for the interest taken by the industry in the co-operative work of this organization.

President Ostby called the meeting to order and announced with much enthusiasm that the progress of the industry was made manifest by the extraordinary increase in the membership, 46 new members having been added during the year.

The report of the Insurance Committee showed that the relations of the acetylene industry with the insurance authorities throughout the country were of growing cordiality, born of the fact that the co-operation for the safety of the public, which has been a feature of this association's efforts during several years, had reached a culmination in the fact that acetylene was now recognized by the insurance authorities as safer than the illuminants which it replaces.

As part of the work of the association, during the past year, the rules and regulations governing the oxy-acetylene blowpipe have been developed by mutual agreement with the insurance authorities, so that this new and wonderful industry will be launched not only properly safeguarded, but with all the advantages which long experience in the lighting field has developed in the construction of generators and the use of acetylene.

Speaking on the insurance side of the question, Mr. W. H. Merrill, head of the Underwriters' Laboratories of the National Board of Fire Underwriters and president of the National Fire Protection Association, congratulated the association on the broad spirit shown which enabled this industry to co-operate with the insurance authorities as none other has done, and then stated enthusiastically the splendid results attained from such co-operation, which he said was an example he trusted would be followed by other manufacturers.

The report of the Press Committee showed that technical and other publications, especially in metal working fields, were devoting a large amount of space to acetylene, and especially to the oxy-acetylene industry, which has now become recognized as a revolutionary advance in metal working.

Professor G. G. Pond, of State College, Pennsylvania, United States authority on the subject of acetylene, addressed the meeting, suggesting certain modifications in the organization so that it might be brought a little more into conformation with the organization in Paris, known as the Central Office of Acetylene.

This was followed by a paper by Mr. L. G. Suscipj, emphasizing the points made by Professor Pond and suggesting the following committees:

House and Town Lighting Committee.

Welding and Compressed Acetylene Committee.

Portable Apparatus and Marine Lighting Committee.

Appliance Committee.

Technical Committee.

Promotion Committee.

A resolution was passed by the association authorizing the president, with the consent of the Board of Directors, to make such changes in the committees as was deemed advisable after investigation. This means a very great extension in the work of the International Acetylene Association, especially through its Technical Committee. It can be readily seen that with a technical committee properly equipped the vexed questions which affect the members of the association will be brought to the attention of those best qualified to supply the answers, and the answers will be made public for the benefit of the whole industry.

Mr. R. E. Boller, of New York, presented a paper on acetylene for heating and cooking. Mr. Boller demonstrated that great progress had been made in acetylene stoves. The discussion which followed showed that, while there had been faults in the acetylene heating apparatus of the past, they had now been corrected, but in spite of this the user in the country had been satisfied and often enthusiastic. The development in the industry as outlined by Mr. Boller, prophecies a very rapid extension in this field. A satisfactory cooking appliance is a a splendid aid to the salesman in selling generators for country lighting.

Mr. M. J. Carney, of the Acetylene Apparatus Mfg. Company of Chicago, presented a paper on "Safeguarding the Industry." This paper again emphasized the necessity of close co-operation with the insurance authorities, and pointed out that every acetylenist should be a missionary, urging careful construction and insisting upon quality in apparatus and appliances. This paper was exceedingly well received, and met with the commendation of the insurance authorities present, who emphasized the points made by Mr. Carney.

A committee was appointed to standardize the threads on gas fixtures and acetylene burners. When the committee reports to the association, a standard thread will be selected and adopted and all acetylene fixtures will then be easily installed, without the difficulties which are now frequent.

The Committee on Pressures, Mr. J. M. Morehead, chairman, reported that after a careful investigation it was deemed wise not to increase the pressure now given by the ordinary acetylene generator of 2 7-10 in., although there were some reasons why a higher pressure might be desirable. They also reported that the improvement in stoves was making it possible to use the lower pressure successfully and economically, and that there would be no particular advantage of a higher pressure for acetylene open flame burners, and that at present no great progress had been made in the mantle burner for acetylene. The committee decided that it was wise not to complicate the industry by a change of pressure until some more urgent reason became apparent.

Mr. W. A. Cochrane of New York read a paper on acetylene lamps for miners, which pointed out the great advantage and paradoxical fact that more and better light and less products of combustion were the result of the use of acetylene miners' lamps, and that there had been a rapid extension of their use during the past year.

Mr. C. F. Mason read a paper on "Automatic Street Lighting," following it with a demonstration of the fact that by changing the pressure on a main, an automatic town lighting apparatus, in which all the errors of the past were corrected, was now available. The extension of town lighting, he stated, would be much more rapid as it would save very considerable expense and would undoubtedly be largely introduced.

Mr. J. K. Rush of Syracuse, N. Y., gave a very interesting demonstration of an automatic electric device for lighting acetylene burners, pointing out the advantage and convenience of the device to the acetylene user, as well as being a great aid in making sales.

Mr. James Pattison of Philadelphia presented a very able paper on the subject of "Marine Lighting Here and Abroad," showing the remarkable progress that has been made in buoy lighting with acetylene, and describing the operations of the ingenious sun valve, which, operating by the light of day, extinguishes the light when darkness falls and ignites it again with the rising of the sun.

Mr. John M. Brock read a paper on

the "Official Organ," a tribute to the *Acetylene Journal.* Mr. Brock's remarks would apply equally well to the trade publications in any industry. He pointed out the tremendous educational advantage of trade literature, and showed that the continuous contributions of the news of the industry, of the scientific attainments in all directions, of the hopes, ambitions and successes of those engaged in any calling, going on year after year, must give more and better knowledge to all those engaged in the industry and almost by unconscious absorption advance more rapidly. We build upon the ideas which come to us and all progress seems to be the crystallization of the information which comes to us from all sources, and surely the trade literature of any industry, if carefully read, is of tremendous advantage to that industry. In the case of the *Acetylene Journal,* the conscientious work of this publication and its editor were most complimentarily referred to, and the industry was called upon to support the publication most earnestly.

The whole spirit of the meeting showed clearly a great and growing enthusiasm, while the papers and especially the discussion showed the advance of the industry and the association's work in every direction.

The election of officers resulted in the selection of Mr. Benjamin O'Shea, president of the Union Carbide Sales Company, for president; Mr. A. C. Collins, of the Davis Acetylene Company, Elkhart, Ind., for vice-president, and Mr. A. Cressy Morrison was unanimously re-elected secretary-treasurer by a rising vote.

The entertainment feature consisted of a theater party, which was attended by the association in a body; a long and delightful afternoon on Lake Michigan, one of the great lake boats having been chartered for the purpose, on which luncheon was served; and the annual banquet which took place on Friday evening at the Chicago Athletic Association banquet room, with Mr. Moritz Kirchberger as toastmaster.

The members in attendance at the meeting expressed themselves as having had a most satisfactory session which the association has ever held, and the prospects for the future are universally regarded as brighter than ever before.

Miscellaneous

EXPERIENCE WITH TUNGSTEN LAMPS AND STREET LIGHTING; papers on the subject read by Claude C. Smith of Bradford, Ohio, and C. C. Custard of the Miami Light, Heat & Power Company.

THE CEDAR POINT CONVENTION OF THE OHIO ELECTRIC ASSOCIATION.

The subject of series tungsten lamps for street lighting was covered by papers on the subject by Claude C. Smith and C. C. Custer. In each case the paper was devoted to the experience of the companies represented by the writers with this type of lamp, and dealt with electrical engineering technology rather than illuminating.

INDIANA ELECTRIC LIGHT ASSOCIATION CONVENTION.

Among the papers presented was one on the "Cost of Light," compiled by the National Electric Lamp Association, and another on "Ornamental Lighting," by Mr. E. Darrow. The papers have not yet been received for review.

ANNUAL CONVENTION OF THE CANADIAN ELECTRICAL ASSOCIATION.

A paper was presented on the "Attitude of the Central Station Manager Toward Illuminating Engineering," by Mr. Roscoe Scott. The following extracts fairly indicate the writer's opinion on this subject:

When some persons think of an illuminating engineer, they mentally picture an elegant suite of offices in a city business block; large files of blue prints and drawings; a private library on illumination; and a lucrative practice devoted mostly to the lighting of boulevards and cathedrals.

While consulting engineers answering to this description doubtless do exist, the average central station man fights pretty shy of them; in fact, it is only the very large station that finds it profitable to retain one or more professional illuminating engineers on its staff.

I submit, however, that the manager who is serving a population of 1000 can, and should, attack his lighting problems in accordance with the same principles that are recognized by the expert illuminating engineer. Rule-of-thumb and guess-so methods are as unsatisfactory in illumination as in any other class of designing.

American Items

NEW BOOKS.

THE AMERICAN PUBLIC LIBRARY, by Arthur E. Bostwick; 355 pages, illustrated with diagrams and half-tones. D. Appleton & Co., New York. Price, $1.50 net.

The author, who is at present librarian of the St. Louis Public Library, and who was formerly in charge of the New York Free Circulating Library and the Brooklyn Public Library, states in the preface that the book is intended for the general reader as well as for those particularly interested in various phases of library work. Indeed, his work will furnish not only instructive but interesting reading for any one who has a taste for knowing how so important an institution as the public library has become in this country, is conducted.

Of particular interest to illuminating engineers is the section of chapter 10 on Library Buildings, which deals with the subject of lighting. The paper on this subject by Mr. L. B. Marks, presented at the convention of the Illuminating Engineering Society two years ago, in which the lighting of one of the branches of the New York Public Library is dealt with in detail, has been largely drawn upon in preparing this section. Four pages of text are given to the subject, and of course it could not be expected that anything but the most general character of information could be given. The information is correct and the advice sound, so far as it goes, and it goes as far as the limits of the book will permit. It is a satisfaction to observe that the subject has been treated from the illuminating engineering standpoint.

THE ELECTRICAL SOLICITORS' HANDBOOK. Compiled by an Editorial Committee appointed by the National Electric Light Association, consisting of Arthur Williams, Chairman; Otis Allen Kenyon, Norman G. Meade, Adolph Hertz and Cyril Nast.

This is the seventh edition of the Handbook, revised and enlarged. Section 3, dealing with illumination, has been entirely rewritten and brought up to date. The section occupies 82 pages of the book and thus leads in point of space occupied. This is significant as indicating the relative importance of illumination to the other applications of electricity as produced by central stations.

The treatment of the subject is as comprehensive as the space will permit, and undoubtedly contains as complete a summary of the science and art of illuminating engineering in its present state as can be found. There is a short introductory chapter, after which the subjects of the Eye, Theory of Light and Color, Calculation and Measurement of Illumination, Illuminants, including the various forms of electric lamps, also illuminating gas, gasoline and acetylene, Photometric Curves, Concrete Examples of Installations, Electric Signs, and Reference Tables follow.

The treatment of luminants which compete with electricity seems to have been written in the spirit of absolute fairness, and with a desire to present the facts as exactly as possible; some of the popular errors concerning gas illumination which appeared in the first edition have been eliminated. The various tables are

especially valuable, and the section as a whole forms an exceedingly valuable compendium of illuminating engineering for the use of those for whom it is especially written, namely, solicitors of central stations.

RAILWAY ELECTRICAL ENGINEERS' HANDBOOK. Written and compiled by C. W. Bender. Published by the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio.

Practically one-half of the book is given up to a consideration of the electrical engineering problems involved in electric car lighting. Following this, sixty pages are devoted to the subject of train lighting, electric lamps and methods of their use. The book is illustrated with half-tones and diagrams, and contains a large amount of valuable matter so condensed as to be available for quick reference. Like all publications of this association, the data given is absolutely authentic, and the treatment of the subject thoroughly scientific and professional.

TESTS OF THE ILLUMINATION OF A LARGE ARENA; *Electrical World*, July 28.

An illustrated article describing the installation and giving the results of the illumination of the military tournament recently held in Chicago, which was described in our previous issue. The results of the tests are as follows:

	Foot-candle.
Under a lamp at edge of field	1.24
Under a lamp at center of field	0.91
Under a lamp at center of field	1.35
Between two lamps in adjacent rows	0.84
Between two lamps in same row	0.86
Between four lamps	0.71
Average	0.99

LIGHTING EFFECTS IN A MODERN HOTEL; *Electrical World*, August 4.

An illustrated article describing the principal lighting features of the new Blackstone Hotel, Chicago. The same installation has been described in previous issues of THE ILLUMINATING ENGINEER.

CANDLE-POWER OF GASOLINE STREET LAMPS; *Electrical World*, August 18.

A report of the tests made before the Council Commission on City Expenditures of Chicago to determine the efficiency of gasoline street lighting. The results of illuminometer measurements made on lamps in place and burning under their ordinary conditions are given in the following tables:

TABLE 1.—PRELIMINARY TESTS OF LAMPS.

Test number.	Estimated horizontal candle-power.	Remarks.	Test number.	Estimated horizontal candle-power.	Remarks.
11	21.2	90 deg. apart.	24	16.0	
11	17.8		25	24.2	
12	17.8	90 deg. apart.	26	19.0	
12	16.2		27	1.9	
16	16.9		28	16.9	
18	29.6		29	17.3	
19	31.2		30	6.7	
20	20.9		31	11.7	
21	27.4		33	15.6	
21	30.8	Lantern door open.	34	16.4	
22	22.0		34	19.8	Lantern door open.
23	18.1		35	19.9	

TABLE 2.—OFFICIAL TESTS OF LAMPS.

Test number.	Horizontal candle-power.	Remarks.	Test number.	Horizontal candle-power.	Remarks.
36	21.1		42	24.0	
37	19.3		43	17.0	
38	54.0		43	24.5	Lantern door open.
39	58.4		44	17.0	
39	64.2	Lantern door open.	45	19.8	
40	27.1		46	14.0	
41	16.8		47	28.0	

A PORTABLE PHOSPHORESCENT PHOTOMETER, by W. T. Vivian and George W. Huey; *Electrical World*, August 18.

An illustrated article describing the results of experiments carried on in the electrical engineering department of the University of Nebraska. The instrument, while theoretically interesting, is not promising in a practical way.

A NEW ERA IN DOMESTIC ILLUMINATION, by W. T. Ryan; *Electrical Review and Western Electrician*, July 2.

A short article dealing in a very general way with the advantages of the tungsten lamp for house lighting.

LIGHTING INSTALLATION OF THE MORGAN MEMORIAL BUILDING AT HARTFORD, CONN.; *Electrical Review and Western Electrician*, August 6.

An illustrated and complete description

of the lighting installation of this building. No numerical data are given.

Decorative and Spectacular Electric Lighting at the Conclave of the Knights Templar in Chicago; *Electrical Review and Western Electrician,* August 13.

An article illustrated with both day and night views, showing special illumination for this gathering.

Illumination of Buildings at the Oregon Agricultural College; *Electrical Review and Western Electrician,* August 20.

A short illustrated article describing the special illumination of the buildings during an electrical show held at the college last fall.

Tungsten Lamp Manufacture, by Newton Harrison; the *Central Station,* August.

Gives the general principles and methods of manufacturing the tungsten filament, and also a discussion of the relation of the tungsten lamp to central station charges.

The Tungsten Lamp as a Factor in Modern Street Lighting, by C. E. Stephens; the *Electric Journal,* August.

A short article reviewing the principal requirements of street lighting with a view to their fulfillment by the use of tungsten lamps. Mr. Stephens' conclusions are as follows:

> Summing up the situation, it may be stated that the advent of the tungsten lamp, with proper auxiliary fixtures, has made it possible to very materially improve street lighting. These lamps are very efficient, reasonably inexpensive to maintain, have fairly low intrinsic brilliancy (when equipped with suitable glassware), and best of all, are available in small units. These units have been spaced at more frequent intervals than has been the former practice, but they are not yet sufficiently close to secure the very best illumination results. It remains, therefore, for the manufacturer of illuminants and the lighting companies to inaugurate a system of education for the public, to teach them that the glaring appearance of a street lamp should not be used as a measure of its excellence, and finally to continually strive to raise the standard of street illumination in our cities to a point where the superior results will justly compensate for the increased cost.

Improvement of Electric Lighting in Old Cars, by C. R. Gilman; *Railway Electrical Engineer,* August.

A continuation of the subject from the July issue. Gives illustrations, with careful numerical data, showing methods of making improvements in the lighting of railway cars.

Gas Arc Lighting, by R. W. Reed; *Progressive Age,* August 1.

This is article No. 3 in the prize competition offered by this journal for articles on this subject. The writer devotes most of his article to relating actual experiences with the gas arc in different installations. Following is his conclusion:

> By the experience we have had with gas arcs in this city, we are satisfied that the inverted arcs are the best kind for gas companies to handle in competition with other lights, both in stores and factories, selling the arc to the consumer, and charging a small amount of about 25 cents per month for each arc for maintenance. In this way you have a sure consumer and by keeping the lamps in good condition with the consumer's money invested in it, he is not liable to be switched over to any other light than gas by the persuasion of any electric or other salesman. Keep to the principle of what you have, hold tight by continual efforts in giving the consumer good satisfaction in this way, and there is no doubt that the gas lighting by arcs will rapidly stride forward. Get permission from the manager of any factory or store to install a few arcs in one portion of premises, no matter what other kind of light he may be using and you will have very little trouble in advancing the use of gas for lighting in every instance.

The Gas Arc, by E. A. Howe; *Progressive Age,* August 15.

This is article No. 4 of this prize series. The writer is manager of the Hamilton Gas Light Company, Hamilton, Canada, and gives the experiences of this company with outside lighting with gas arcs, giving illustrations of typical installations. He differs from Mr. Reed on the advisability of selling the lamps:

> It has been my experience in the States that to sell a lamp is a mistake for many reasons. In the first place the gas company sells to a merchant a few lamps on the installment basis, say, for \$5 down and \$1 per month, and at the end of the year the lamp becomes the property of the storekeeper. In the

meantime the gas company cares for the lamp twice a month. This system works very well while the gas company is maintaining the lamp, and it assures satisfaction to both parties.

As soon as the lamp becomes the property of the storekeeper he wants to take care of it himself, and claims he can do it as good as the gas company, and cheaper. This has always proved a failure. Whether he can clean it as good or not, he fails to do so, and the result is he has a dilapidated looking lamp hanging in his store with mantles broken and globe dirty, which soon becomes an eyesore not only to the storekeeper himself but every one else who passes by and looks in. The gas company has not only lost the maintenance of the lamp, but a consumer, and perhaps a good one. The chances are that they will never be able to get this man back again as a gas consumer, because he feels he has not received the value of the money he has expended in buying the lamps, and is very dissatisfied with his investment.

A SPECTACULAR GAS LAMP INSTALLATION, by W. Laidlaw; *Progressive Age*, August 15 .

An illustrated article describing an installation of outdoor gas arcs on a high pole during the Iowa District Gas Association meeting in Sioux City.

PIER LIGHTING AT BALTIMORE, by S. E. Chubbuck; *Progressive Age*, August 15.

Describes the installation of gas arcs in the pier of the Merchants' & Miners' Transportation Company at Baltimore, giving night and day views.

LIGHTING OF THE SHARPSBURG BRIDGE, PITTSBURGH, by W. D. Patterson; *Progressive Age*, August 15.

An illustrated article describing the installation of gas arcs for the illumination of this bridge. Figures are given showing cost of maintenance as compared with electric arcs.

SOME NEW FORMS OF PHOTOMETRIC INSTRUMENTS, by a London correspondent; *American Gas Light Journal*, July 25.

Gives diagrams and a description of the Harrison photometer, in which the variation of the standard light is produced by a method of applying the cosine law. The instrument is an approximation instrument intended for rapid readings.

ILLUMINATION WITH GAS ARCS; *Light*, August.

Gives illustrations and brief descriptions of a number of notable installations of gas arcs from both interior and exterior illumination.

ILLUMINATION OF CITY MARKET AND PUBLIC HALL; *Light*, August.

Describes the lighting of the market hall in Indianapolis with reflex gas lamps and the lighting of the public market with gas arcs.

LIQUEFIED ILLUMINATING GAS, by Walter Langford; *Scientific American*, August 13.

A popular description of the method of manufacturing Blau gas, with illustrations showing apparatus and illumination.

LIGHT WHEN THE DAYS GROW SHORT, by James R. Cravath; *Factory*, September.

The first of a series of articles on factory lighting. Gives illustrations showing good and bad illumination in some special cases of factory work.

LIGHTS, INTENSITIES, POWER AND VOLUME, by George A. Rogers; *Optical Journal and Review of Optometry*, July 28.

A short chapter giving the fundamental propositions in measuring light. The same article is continued in the issues of August 4 and 11.

EDITORIALS.

THE RATING OF LAMPS IN STREET LIGHTING SERVICE; *Electrical World*, August 4.

THE QUARTZ MERCURY ARC IN STREET LIGHTING; *Electrical World*, August 4.

A STUDY IN PHOSPHORESCENCE; *Electrical World*, August 18.

SAFE ILLUMINATION; *Electrical World*, August 25.

SOME CONSIDERATIONS RELATIVE TO ORNAMENTAL STREET LIGHTING; *Electrical Review and Western Electrician*, July 30.

KNIGHTS TEMPLAR ILLUMINATION IN CHICAGO; *Electrical Review and Western Electrician*, August 13 .

Foreign Items

Compiled by J. S. Dow.

ILLUMINATION AND PHOTOMETRY.

Appareil Transportable Universel pour mesure des constantes des Lampes a Incandescence, by M. Aliamet (*l'Electricien*).

Describes a portable apparatus for determining the candle power, current, and watts taken by incandescent lamps.

L'Eclairage des Phares par l'Electricite, by J. Benard (paper read before the Société des Ingenieurs Civils de France; *Rev. Electrique*, June 30).

Les Projecteurs Electriques Militaires, by A. Bochet (*Bull. de la Société des Electriciens*, May).

These two papers deal with electric searchlights. The latter is of special interest. The author describes the different systems of "group-flashing," etc., and discusses the relative merits of opaque and lenticular reflectors. In addition, he gives an illustration showing the application of a military searchlight to illuminate the white surface of a house by night.

Valeur des divers modes d'Eclairage au point de vue ophthalmologique, by Gariel (*Rev. Electrique*, June 30).

This is a summary of a paper read before the Société Ophthalmologique de France. The author commences by discussing the effect of ultra-violet and infra red radiation on eyesight. He describes some experiments which suggest that one reason why we cannot see ultra-violet light is that this kind of energy is absorbed by the eye-lens. In addition, the eye gradually acquires this absorbing quality as a protection during life, so that young people can sometimes actually perceive as luminous a source giving out only ultra-violet energy, and no "visible" light, when adults cannot. The author also discusses color photometry and other matters, and gives a series of figures for the illumination in different interiors. He recommends a minimum illumination of 15 lux for fine work.

The Illumination of Interiors, by Prof. J. T. Morris (*J. G. L.*, July 12; *G. W.*, July 2; *Illum. Eng.*, Lond., July).

The above popular lectures on illumination have already been alluded to in the last review.

The Report of the Chief Inspector of Factories for 1909 (Great Britain).

The report of H. M. Inspector of Factories for 1909 is alluded to in the editorial of the July number of the *Illuminating Engineer* (Lond.). The subject of illumination receives much more attention than it has hitherto done, and a number of inspectors mention instances of bad illumination proving detrimental to health and efficiency in working. The Home Office recognizes this and also comments on the risk occasioned by bad lighting in the case of trades involving the handling of poisonous materials. The authorities are now making a special study of the matter and a number of measurements of the illumination of underground premises have already been made.

The Illumination of the Exteriors of Buildings at the Brusselles Exhibition (*A. E. G. Zeitschr.*, July).

Describes a novel system of illuminating the exterior of a building by concealed glow lamps in preference to the usual method of outlining the architectural features in naked glow lamps. The effect is said to be very pleasing, and the contrast between the red tiled roof and gables and the white walls is strikingly brought out. Some miniature lamps are also used to outline portions of the roof, but the candle power is too low and the lamps too distant to cause any impression of glare.

Illumination, Its Distribution and Measurement Continued, by A. P. Trotter (*Illum. Eng.*, Lond., July, 1910).

Gives particulars of a series of measurements of the illumination of streets, etc., in 1892. Among other buildings investigated, some results of measurements in the South Kensington Museum in 1892 are also given.

The Lighting of the Old South Kensington Museum (*Illum. Eng.*, Lond., July).

Discusses the lighting of the older portion of the South Kensington Museum (London). The author criticises the lighting in several respects and urges that in many places there is not enough light for the exhibits to be properly seen.

The Calculation of Illumination, by C. Toone (*Elec. Rev.*, June).

Some Views on Street Lighting and Street Photometry (*Illum. Eng.*, Lond., July).

A summary of recent views on this subject. Reference is made to the publications of some American authorities and also to the recent report of the photometrical sub-committee of the Verband Deutscher Elektrotechniker. Particulars are also given of the Hrabowski reflector for flame arc lamps and other recent developments in street lighting fixtures.

ELECTRIC LIGHTING.

Practical Notes on Illumination by Cooper Hewitt Mercury Lamps, by L. Crouch (*Elec. Rev.*, July 15, 22).

The author tabulates a considerable amount of data regarding the mercury vapor lamps and gives particulars of intrinsic brilliancy, color, etc. He also presents curves and tables showing the distribution of illumination with the lamps hung at various heights above the ground.

Nouveau Mode de Groupment des Lampes a Incandescence, by De Kermode (*L'Electricien*, June 4a).

Describes the Weissman system of using a large number of small lamps in series parallel. Lamps of 14 volts and giving one candle power are preferred for a 100-volt circuit. As arranged the failure of one lamp is of small consequence, as it scarcely affects the general illumination. In addition the low voltage lamps are claimed to be exceptionally efficient and to last for 2000 hours or more.

Die Strahlungseigenschaften der elektrischen Gluhlampen, by G. Leimbach (*Zeitschr. f. Wissentschaftliche Photographie*, etc., July).

A general article giving information about the scientific aspects of electric lamps. Polar curves of light distribution of the chief incandescent lamps are presented and a table of luminous efficiencies is given.

Der Unterschiedsfactor elektrischen Zentralen, by G. W. Meyer (*Z. f. B.*, July 20).

Systems of Charging and Metallic Filament Lamps, by W. A. Toppin (*Elec. Review*, July 1).

Lampes a Arc (*Rev. Electrique*, July 18).

A useful summary of some recent developments in connection with arc lighting. The Beck mechanism and series resistances are described. The latter consist in the use of fine wires run at a high current density and mounted in glass tubes. The dioptric globe and some of the most recent types of reflectors for arc lamps are also dealt with.

GAS, OIL, ACETYLENE LIGHTING, ETC.

Gasdruckfernzundung der Strasslaternen, by Buhe (*J. f. G.*, July 23).

Reconsiders the value of automatic control of street lighting. The author contends that the conclusions of Dobert and Göhrum on this point were unduly favorable; it is not invariably true that distance lighting is effectual, but only in certain circumstances. He also declares that the fluctuations in pressure to control the lamps are found troublesome by many consumers.

Bericht der Lichtkommission; Untersuchungen Gebrauchlicher Sicherheitslampen, by W. Leybold (*J. f. G.*, July 16).

An account of investigations on various types of standard safety lamps. The distinction between such lamps for use in gas works and collieries is pointed out. It is anticipated that, as a result of further experiments to be undertaken shortly, more precise regulations on this point and also as regards illuminating power will be made.

Illumination by Using Inclined Incandescent Mantles, by G. de Schodt (paper read before the Société Technique du Gaz; *J. G. L.*, June 28).

The author describes the use of mantles inclined at any desired angle, and backed by a suitable metallic reflector. By this means the natural polar curve of light distribution can be modified to suit the local circumstances, and the angle can be adjusted to the most favorable inclination. In addition a cluster of three or more such mantles can be very effectively utilized for street lighting, the amount of light thrown on the pavement being substantially increased.

The Victory of the New Standard Burner (*J. G. L.*, July 19).

This is an editorial note bearing on the referring to the scheme for the adoption of a common testing burner for gas companies in Great Britain. The scheme has been approved by the committee appointed to investigate the matter, but the bill before Parliament is still the subject of some opposition.

The Promotion of the Sale of Gas (*J. G. L.*, July 19).

Comments on the enlargement of the scope of gas supply and the tendency toward the installation of vast networks of mains. For example, gas is now transmitted under pressure from Lübeck to Travemünde, 30 miles away, and also from the station in Berlin to outlying suburbs at an equal distance.

Public Lighting—Competition and Charge (*J. G. L.*, June 7).

Gives an account of the development of the early gas companies, and the methods of charging in vogue before the use of exact measuring apparatus became general.

Beitrage zum Beleuchtungswesen in Deutschland; I.—Munich.

This marks the commencement of a series of articles dealing with the development of gas lighting and gas supply in Germany. The present article deals with the town of Munich.

Neue Invertbrenner (*Z. f. B.*, July 10).

Beleuchtung mit flussigen Leuchtmaterialen (*Z. f. B.*, July 10, 20).

Gas Lighting at Brussels (*G. W.*, July 2).

Gas at the Franco-British Exibition (*J. G. L.*, June 7).

Das Gas in der Werkstatt (*Z. f. B.*, July 10).

Portable Acetylene Lights for Emergency Lighting (*Illum. Eng.*, Lond., July).

Describes the use of portable acetylene outfits for the lighting of buildings in emergencies or for the illumination of works in construction, unloading at wharfs, etc., and in other cases where gas or electricity are not available.

L'Eclairage de Paris et son influence sur la securite (*Rev. des Eclairages*, July 15).

Deals with some recent discussions on the turning off of public lamps at midnight. It is pointed out that the maintenance of this lighting after the late hours is of considerable assistance to the police, dark streets being notoriously favorable to the resort of criminals.

The Recent Acetylene Explosion at Sharavogue. Castle (*Acetylene*, July).

A recent explosion through a leak of acetylene was, it is suggested, due to the use of lead piping which was gnawed through by rats. The use of lead and composition piping, which only cheapens an installation by about 10 per cent., is condemned on the score of insecurity, and the writer suggests that in such cases the very best quality only should be used.

Phares et Signaux (*Rev. des Eclairages*, July 15).

Acetylene Revolution in Coast Lights (*Acetylene*, July).

The
Illuminating Engineer

Vol. V OCTOBER, 1910 No. 8

THE RISING GENERATION

During the month of September practically an entire generation of the future citizens of this country will enter school. As the active members of society are included in two generations, it follows that nearly half of the native constituent of our population a generation hence is now studying in the various schools of the country.

This study means a continued and exacting use of the eyes—in the majority of cases a more severe use than they will ever again be subjected to. Furthermore, the majority of eyes thus put to the test will be those of comparatively young children. With the fact established that eye-strain is not only injurious to the eyes themselves. but has a profound influence upon the nervous system and general health, the importance of furnishing the best possible conditions for this eye work assumes an importance secondary to no single question affecting the conservation of the human resources of the nation.

Compared to its importance there is no other matter in the whole scheme of education that is so woefully neglected at the present time. The only fortunate feature of the case is the fact that much of the study is done under fairly favorable daylight conditions; but more and more is the work being extended into the hours when artificial illumination has to be used.

The large majority of lighting installations in schools, both public and private, is little short of criminal. Those guilty of this criminal negligence are the more culpable for the reason that science has placed within their hands the means of wholly removing this dangerous condition.

There is not even the excuse that furnishing illumination that would be practically equal to daylight is expensive. Generally it would be less expensive than the wretched lighting now used; but even were it not, who would care to take the responsibility of setting a money value upon the eyes and constitutions of the rising generation?

The illuminating engineering fraternity and all others interested in the welfare of the country should make it their personal business to bring about a reform in the lighting of the schools, and their co-partners in education, the public libraries and reading rooms.

E. L. Elliott.

Industrial Lighting and Public Health

Need of Legislative Regulation.

By E. Leavenworth Elliott.

No subject of general public policy has been so much taken to heart by the American people as the question of conservation. Possessed of a land teeming with the richest profusion of Nature's bounties, it is natural that Americans should have become the reckless prodigals of this natural wealth that they are. But as there is no private fortune that can withstand the spendthrift's waste forever, neither will the most bountiful natural resources hold out indefinitely against thoughtless waste and extravagance. While no one in the present generation need give himself any worry as to his supply of coal, wood, metals or other natural products we owe a certain duty to future generations and cannot with a clear conscience squander the patrimony to which they are heirs by divine right.

It is well that we give thought to the morrow in regard to the material resources of our country; but there is another resource of still greater importance —namely, the public health. Upon this even the existence of future generations depends. To conserve the human resources of the nation is manifestly of more imminent and vital consequence than to conserve its material resources.

When the framers of our Declaration of Independence declared that all men are created equal they surely did not intend to set forth the palpably fallacious dogma that all men are created with equal talents, but rather that they come into the world endowed with the same rights to the common inheritance of man, among which, as they stated, are life, liberty and the pursuit of happiness. The first and last of these inalienable rights presupposes a reasonably perfect state of health; for the extreme limit of ill-health is death, and happiness is pursued in vain without the blessing of health. To provide for the three chief rights of man may, therefore, fairly be said to be the whole purpose of government.

Any government that permits the health of its citizens to be put in jeopardy fails in its purpose to an extent secondary only to a failure to protect their lives. That equally stringent laws have not been made looking to the conservation of the public health can only be attributed to the fact that the relation between cause and effect in this case is less easily traced. Murder will out—unnatural death usually bears ample evidence of its foul intent, but impaired health is not so readily traceable to the first cause. Modern science has bestowed a double blessing upon humanity: it has provided incalculable material means contributing to human happiness, and it has shown the way, to a large extent, of avoiding sickness and death, and thereby added to man's ability to enjoy these material blessings.

General Neglect of the Danger of Eye-Strain.

Probably no phase of human ills has received so little attention at the hands of modern science as those resulting from misuse of the eyes. Americans are fast becoming a race of neurasthenics. While the more conspicuous causes resulting from our habits of high-pressure, intensive living are generally blamed for this condition, the undoubtedly large part which eye-strain contributes is almost wholly overlooked. While the homes of our grandfathers perhaps contained three or four books, which were kept rather for the sake of respectability than for actual reading and their current literature was comprised perhaps in a single weekly paper, young America to-day is deluged with print, from the infant's magazine to the twenty-third edition of the daily newspaper, with its microscopic type and wretched quality of paper. Instead of the eye resting easily without conscious focus upon the various objects in the landscape, the children of to-day are required to spend a large part

of their time in reading books printed with light-faced type on glossy paper; and when not so engaged often spend their leisure hours in miscellaneous reading, generally without the slightest regard to the proper use of their eyes.

When the stress of school work is over the already overstrained optic nerves are required to follow with close scrutiny the objects upon which the hands are working. The enormously complicated and refined processes that enter into the manufacture of the innumerable articles of commerce to-day; the definite hours of work, frequently entirely included within the portion of the day when there is no natural light, and the necessity for the quickest possible action, have thrown a labor upon the eyes which was entirely unknown two generations ago. Added to this condition is what has been termed "the woman's invasion" in the field of labor; and a third addition should be made to include the large part which minors and young children bear in the industries of the present time. All these conditions involve a tax upon the organs of vision that demands the most thoughtful attention upon those interested in the conservation of our human resources.

Misuse of Modern Light-Sources.

In reply to these warnings it would be very natural to ask: "Has not science given us better lights which will fully compensate for the increased strain upon the eyes?" The answer to this question involves the whole point at issue. Science has given the means of producing light, and has shown how it should be used to preserve and to protect the eyes; but there the power of science stops. To see that her dictates are carried out is a duty of society in general and not of the scientist in particular. Science has discovered many new chemical substances which are exceedingly valuable medicinally when used under the proper conditions and with proper precautions; but it has been found necessary to prevent their indiscriminate use, which is fraught with most serious dangers to the public health. Likewise the new light-sources which are such vast improvements from the purely scientific standpoint over anything known before must be used with proper care and intelligence, or they become a serious menace to the eyes and health of those using them.

It has been proven time and time again that to provide for the health and comfort of workers is a profitable investment for the employer, and yet neither motives of self-interest nor humanity have proven sufficient to insure the largest measure of protection to the health of the individual worker, so that the State has had to step in and insist.

The importance of the proper care of the eyes not only for the sake of the eyes themselves but of the general health, and the opportunities for abuse in this regard under present manufacturing conditions and with modern high-power light-sources combine to produce conditions which demand legislative regulation and supervision. As this is a question of State jurisdiction, every State should incorporate in its laws the necessary provisions for insuring adequate and safe illumination for all wage workers. Such legislation will work no injury or hardship to any manufacturer, large or small. On the contrary, it will subserve their interests by insuring greater efficiency of labor. The States generally have certain provisions for the inspection and regulation of factories, and legislation along these lines has made special progress in recent years. Let it at once take this further step and place illumination among the facilities subject to inspection and regulation.

Intensive Labor of To-Day a Severe Test on the Eyes.

The invention of labor-saving machinery and the continual shortening of the working day have combined to make human labor more intensive. A single instance will illustrate this fact. Some two years ago the labor union cut down the working day of the printers by an hour; whereupon at least one employer at once speeded up his presses 10 per cent. Thus, the workman accomplished practically the same results as before, *i.e.,* he was obliged to work enough faster to make up for the loss of time. In the old days of hand labor and long hours there was neither the possibility nor the inclination to drive at high speed; everything was

done in a leisurely manner. Now, the laborer is in the majority of cases a part of the machine—its eyes and brain, and must act with the incessant rapidity of a well oiled mechanism. This means that the nervous system is worked at high pressure, and under continuous strain.

Particularly does this hold true in the various trades in which female labor is employed. By natural selection such labor is chosen for the finer and more delicate operations in manufacture, and these operations require both keener vision and quicker response to the visual impressions received. Both of these conditions contribute to nerve strain. It is useless to try to turn back the wheels of progress into the old easy-going paths; the development of machinery and the specialization of labor will continue in spite of any and all legislation that might be enacted. The direction of effort must be in the way of meeting these new conditions with every reasonable and proper safeguard for the health and happiness of the laborer.

Female Laborers Particularly Subject to Eye-Strain.

Whatever may be said for or against the ethics of the " women's invasion " of the field of labor, the invasion has been accomplished, and it remains now to see that the results produce the maximum benefits and the minimum evils. The difference in constitution of women and children must be clearly and distinctly recognized in the protective measures enacted for their benefit. One of the most obvious of these distinctions is a more sensitive and higher developed nervous system; hence, the special importance of regulating conditions which directly affect the nerves. Since eye-strain more directly reacts upon the nerves than the strain of any other organs of the body the necessity for the most careful attention to light, both natural and artificial, is of paramount importance.

There is a large class of female labor which as yet has been left entirely without the pale of legislative protection. This includes all of those employed in clerical and general office work. Such work requires constant and severe use of the eyes, and it is safe to say that in no other line of work is the artificial lighting so bad. The modern tendency to erect office buildings higher and higher tends to more and more shut out the light of day. Even the smaller cities, in their desire to acquire a metropolitan air, are putting up buildings whose height is out of all proportion to land values. In the larger cities there are thousands of offices into which a ray of sunlight never enters, and in which, for the greater part of the working hours, artificial light must be used. On the other hand, the tendency in the case of factories is to get out of the cities into the country, and to build even one story structures with every possible facility for daylight illumination. By comparison, therefore, the office worker is in greater need of the protective care of the State, so far as light is concerned, than the factory worker.

What Regulations Are Practicable?

" That there are serious abuses of the eyes resulting from bad illumination may readily be conceded; but just what specific regulations should be made to correct these evils? Are the principles of illuminating engineering sufficiently settled to serve as the basis for so important a step as legal enactments? " These are questions that will naturally arise in the minds of those interested specifically or casually in the subject. The reply is, that legislation can never be perfect so long as it is human to err. In spite of the best efforts of legislators thus far there are numerous and serious evils that remain unsolved in the labor problem. The fact that we may never reach perfection does not justify us in refusing to make any efforts for betterment. While it is true there are many points in practice which are yet matters of dispute in illuminating engineering,—a condition, by the way, which holds equally true in all other professions—there are certain practices that are indisputably bad, and it is against these that regulation should be aimed. A degree of darkness that endangers life or limb is unquestionably a condition that can be reached by specific regulations. The shielding or removing of dazzling light-sources is another positive danger that can be definitely specified. Such regulations should never attempt to go into the finer points of

practice, which must naturally change in the development of the art, and be subjected to conditions beyond the control of set rules.

The moral effect of recognizing illumination as a facility of such importance as to require governmental regulation would in itself be of far-reaching value in directing the attention of employers to the subject. Let us at least have the matter put before the proper authorities, that a full and complete discussion of it may take place to the end that such legislation as may be enacted express the highest wisdom of the illuminating engineering profession at the present time.

Another Western Instance

By Harry F. Viot.

Much has been said regarding the progressiveness of Western cities and towns, and the untraveled Easterner retains a deepseated notion that most of this talk is simply the Westerner's habit of real estate booming. That there is a very substantial basis for the Westerner's claim, however, has been frequently alluded to in these pages, and is set forth by the readiness with which they have taken up decorative public lighting. This mark of progress has by no means been confined to the larger cities, but has spread out to the smaller towns.

The most remarkable example that has yet come to our notice is that of Winterset, Iowa, a town which boasts of a population of 1500, and has a real "White Way," a view of which is shown in Fig. 1, illuminated by 39 handsome cluster lampposts, each fitted with four 40 watt and one 60 watt tungsten lamps. This is at the rate of one lamppost for every 400 citizens. At this rate New York City should contain 120,000 decorative lamp standards. Taking Winterset as a standard of public lighting, the extent of opportunity for the sale of lamps and electric current for this purpose in the other cities and towns in the United States is something whose contemplation will make the central station dizzy.

FIG. 1.—ORNAMENTAL TUNGSTEN STREET LIGHTING AT WINTERSET, IOWA, A TOWN OF BUT 1500 PEOPLE.

Railway Train Illumination

By Ralph Birchard.

Railway train illumination is not a very good historical subject. History cannot be seen in its true perspective until some years after it has been made, and the story of railway train lighting is a story of yesterday and of to-day. One does not have to be an oldest inhabitant by any means to remember the time when railway trains put up for the night, and sleeping cars were looked upon as a humorous absurdity.

It is not surprising that for some years after regular night train service had been established, the lighting of them received small consideration from the railway men. To be permitted to travel at all was so much of a privilege that a public which demanded more was thought nothing less than ungrateful.

As a mere matter of expediency to permit the conductor to collect the passenger fares, a certain amount of illumination was necessary. For this sperm oil burning feebly at the ends of small wicks was considered eminently satisfactory. The conductor carried his own lantern with him, anyway. In the natural course of railway development some improvement was made in these oil lamps, and though they are to-day regarded as hopelessly obsolete contrivances, they compared very favorably with the street and house lights of fifty years ago.

With the improvement of transportation facilities, and especially with the advent of the luxurious sleeping car, the imperative need for adequate car lighting began to be felt. Traveling, which had hitherto been done chiefly from necessity, now came to be done for pleasure. The

FIG. I.—OLD STYLE BARE LAMPS, WITH FROSTED BULBS, NO LONGER REGARDED AS GOOD PRACTICE IN TRAIN LIGHTING.

FIG. 2.—A CAR IN WHICH GAS LIGHTING FIXTURES HAVE BEEN ALTERED TO CONFORM TO THE BEST PRACTICE IN ELECTRIC LIGHTING.

public would no longer tolerate the dreariness of a long ride in very subdued twilight. People grew intolerably tired of sitting hour after hour with nothing to do. They wanted to read. They did read, too, although it is probable that a good many pairs of eyes were ruined in the process by the poor illumination that prevailed for so many years.

The first long step in the improvement of railway train lighting was made when Pintsch gas system was invented. This was a scheme for making illuminating gas from petroleum, and compressing it in small tanks which could be carried under the body of the car. It was tried first in Germany. For a long while it was far from satisfactory. The unsheltered flames were prone to blow out, filling the darkened car with explosive and poisonous gas. Explosions of the tanks occurred frequently enough to keep the nervous traveler in a state of continual dread. Considerable difficulty was experienced in getting a regulator which would keep the pressure on the burners constant.

But, gradually, these difficulties were overcome, until by the time of the World's Fair at Chicago in 1893, most of the first-class through trains in America were equipped with Pintsch gas lighting systems which were giving excellent service. It is true that the light from these systems was frequently inadequate, but this was due to the misguided economy of the car builders in not using a sufficient number of burners, and not to any inherent fault of the system itself. Pintsch gas gives a mild, yellowish light of rather low intrinsic brilliancy, and without appreciable flicker. It can be produced at comparatively low cost. It requires very little attention from the trainmen. Compared with the oil lamps which it replaced, it was, indeed, a vast improvement. But it has one great drawback—the danger of explosion and fire in case of collision or derailment.

The seriousness of this objection is realized only after a study of the great railway wrecks of recent years, which shows that by far the greater share of the fatalities have been due, not to the shock and ruin of the wreck itself, but to the fires and explosions which came after it. So important does this objection become after a study of this kind that it may well outweigh all the other advantages. Following instructions given by their national parliaments after consideration of the matter, the governments of Austria, Italy and Germany are to-day engaged in the

work of removing all gas lighting equipments from the cars of the state railways and replacing them with electric lighting sets.

It is less than fifteen years since the first electric train lighting equipments were being tried out in this country, and it is only within the last five years that they have come into general use. Reasons for this are not far to seek. The operator of an electric train lighting plant has to contend with every difficulty that besets the average central station superintendent, with the added troubles that the unstable condition of his transmission lines impose. Nevertheless, electricity gives so much better illumination than any other source that it is to-day universally recognized as the standard lighting for passenger trains the world over.

There are three distinct systems of electric train lighting. The first is called the "Head End System" for the reason that the generator is located on the first car of the train, taking live steam from the locomotive boiler. Steam turbines of 15 or 25 kw. capacity are now in general use. Although extremely wasteful of steam, they are reliable and do not require much attention. The gasoline engine has been tried and found wanting. It was given to balking at inopportune times, and had the same frightful racking effect that was the chief fault of the reciprocating steam engine. With a head end system it is necessary to provide some means of lighting the train during the time when it is cut off from the locomotive. This is done by placing in the train several cars equipped with storage batteries. When the generator is out of the lighting circuit these batteries are automatically cut in. They are charged during the later hours of the night, when the lamp load is not more than a third of what it was during the earlier part of the evening. Considerable difficulty has been found in regulating the lamp voltage on this system. The line drop is large and varies a good deal with the care (or lack of it) with which the connections between the cars are made.

The second method is called the "Straight Storage System." In this sys-

FIG 3.—PARLOR CAR IN WHICH OLD ELECTRICAL FIXTURES HAVE BEEN BROUGHT UP TO DATE.

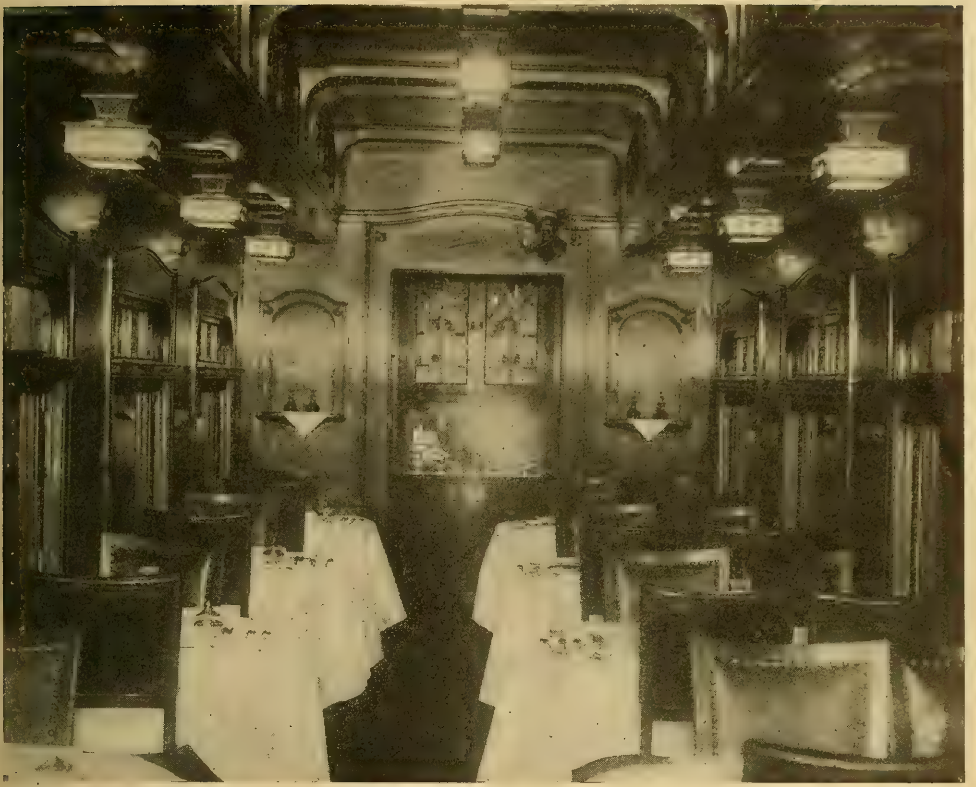


FIG. 4.—BOX LIGHTING FIXTURES IN A MODERN DINING CAR. ORNAMENTAL, BUT NOT VERY EFFICIENT.

tem each car is equipped with a set of storage batteries of sufficient capacity to light it on its journey. The cells are charged at the terminals and discharged en route. Very satisfactory illumination has been secured in this way. It is, however, decidedly uneconomical because of the low efficiency of the batteries, and the great weight of them which must be carried in order to furnish the necessary current.

The third, the newest, and undoubtedly the best system, is that in which each car is equipped with its own dynamo and storage battery. The dynamo is belted to one of the car axles, and is so arranged that it begins to furnish current as soon as the train attains a speed of twenty miles an hour. This current supplies the lamps and keeps the batteries charged. If no lamps are burning and the battery is fully charged, the dynamo is automatically cut off and furnishes no current, although the armature continues to revolve. As the power taken from the train is negligible, and as the whole outfit is entirely automatic, requiring no attention whatever from the trainmen, this system is at once the most satisfactory and most economical of all.

The introduction of electricity for car lighting made it possible to place small lights in berths, and at other points in the car than up near the ceiling. Reading lights are now conveniently located over the reader's shoulder. Writing tables are lighted with small fixtures out of the line of vision. In short, lights can be placed where light is needed.

The first installations of electric lights on trains came far from satisfying the requirements of the illuminating engineers of to-day. They produced sufficient light, it is true, but that light was distinctly lacking in what, for want of a better term, we call refinement. Unprotected bare

FIG. 5.—BEST MODERN PRACTICE IN ELECTRIC LIGHTING OF CHAIR CARS.

lamps dazzled the eyes of the traveler whichever way he looked. The light was there all right, but instead of illuminating it actually obscured. One look at the blazing bulbs and it was some time before anything else could be seen.

It was not long, however, until the electrical engineers installing the equipments began to realize that there is something more to illumination than light. Soft shades and artistic fixtures came into use. The bare lamp became distinctly bad form in car lighting. In speaking this way it must be remembered that we are now considering the best practice on the best trains. There are vastly more bare lamps than there are shaded ones in use to-day, but they are no longer regarded as anything better than a temporary makeshift to be improved upon as soon as possible.

Nearly all American cars are finished in dark woods. These absorb a good deal of light and increase the cost of illumination correspondingly. Until very recently all cars have been built with a deck sash roof, and this is probably the reason why indirect illumination has not been seriously attempted in America. The deck sash has been considered necessary for strength and ventilation, but with improved ventilating systems and steel car construction it seems destined soon to pass away, and indirect lighting systems will then become possible.

The tungsten lamp is now in almost universal use for railway train lighting. With the latest improvements in this style of lamp, the objection of fragility has been largely overcome. The lamp stands up well under moderate variation from normal voltage and gives rather high efficiency.

The " tube " railways of London have adopted the most advanced style of lighting. The cars on these lines are with " turtle back," nearly flat, roofs. The slightly curved ceiling is finished in white

FIG. 6.—GAS-ELECTRIC CAR, WTIH FLAT CEILING, SHOWING THE POSSIBILITIES OF CARS OF THIS TYPE FOR INDIRECT ILLUMINATION.

and acts as a very efficient reflector for the tungsten units, which are placed at intervals in the center of the car. Seven 55-watt lamps in "opalite" globes, which throw a considerable portion of the light onto the ceiling, serve to illuminate each car.

There is still room for a great deal of improvement in American railway train lighting, not so much in the invention of new methods as in bringing the illumination of the great bulk of passenger coaches up to the standard which now prevails on the best trains.

FIG. 7.—A MODERN ELECTRIC CAR LIGHTING FIXTURE.

Railroad Illuminating Engineering

VI.—OFFICE LIGHTING

Large Clerical Offices—Drafting Rooms

By Harold Kirschberg.

The accounting side of a railroad's business is of paramount importance to the road and should be furnished with all facilities for the efficient conduct of business. Not of secondary value among such facilities is the lighting installation, and in view of the peculiar conditions to be met in providing a satisfactory installation it is certainly not amiss to consider the problem in detail.

The type of clerical office which presents the greatest number of conditions to be satisfied is the large office up to about 100 ft. in length and varying in width from 20 to 100 ft. Such an office may be treated in a manner similar to that accorded a drafting room. The arrangement of desks, filing cabinets, typewriters, calculating machines, etc., may be regular and dependent upon window locations and spacing, or may be very irregular, being spread about the room with no regard to any architectural features of the building. Some of the desks may have additional tops for books, necessitating some means for obtaining light below the shelf. Other desks may be of the roll top type, which throws its own shadow on the table portion of the desk. Flat desks or tables placed between rows of lamps are very certain to cause those working at them to do so in their own shadow. Other desks may be placed against the walls or even in the corners, and a lighting layout which will furnish sufficient illumination at every point in the room will be capable of being used more or less locally as well as generally, and will be efficient, as the desideratum for this class of work.

There are still, however, a number of other conditions to be met, the most important of which are as follows: Different colored inks are used with different significance, and it is to be greatly desired that the difference in color between black, blue and red inks is readily discernible under the artificial light. In a number of railroad offices not only is ordinary lead pencil used to a great extent but also copying pencil, both of which provide so good a reflecting surface that in a number of positions of the paper the writing is entirely blurred and indistinguishable. Highly calendered paper offers its own objections, due to regular reflection from its surface, while all of the foregoing conditions, if not met correctly, impose a degree of eyestrain and consequent fatigue which is usually aggravated by the long hours of closely applied work customary.

The additional objection of sources of high intrinsic brilliancy in the field of vision, due to the large dimensions of the room, is apparent in itself. The result on the working force is the usual necessity for glasses and eyeshades after a short time, the production of headache and eyeache and a nervous condition productive of poor, inefficient and unsatisfactory work. Considering also the fact that during the fall and winter months quite a portion of the work is done during the twilight hours, when the conditions imposed on both the power of accommodation of the eye and the lighting installation are most severe, it is apparent that a satisfactory lighting layout must be such as to be comfortable at all times. It is well known that an illumination which is perfectly satisfactory during twilight hours is usually very glaring during the hours of darkness. A means for the reduction of such glare is, therefore, most necessary.

A number of methods of solving the problem presented in the foregoing paragraphs has been devised, and may be enumerated as follows:

First.—Individual Desk Lamps.

This has been the commonly accepted correct solution until a comparatively short time ago when general lighting for the entire room was introduced. The objections to the individual desk lamp scheme are:

(a) The desk space taken up by the desk lamp.

(b) If a drop lamp is used instead, the

large number of drop cords is objectionable from a standpoint of appearance, safety and initial labor and material cost.

(c) The necessity for a great number of ceiling, wall or floor outlets.

(d) The necessity of moving outlets every time a desk is moved to some other position.

(e) The inconvenience of lamps and shades in the field of view and the necessity of looking around them to the other side of the table.

(f) The close proximity of a hot lamp to the head.

(g) Eyestrain produced by working in an intensely illuminated spot.

(h) Inability to satisfy all the aforementioned objections involving glare and color distinction.

(i) Lack of sufficient general illumination in the room for filing cabinets, typewriter desks, etc.

SECOND.—UNIDIRECTIONAL ILLUMINATION.

This scheme has been used with opaque reflectors, all throwing the light in the same direction, the working force all facing in that direction and receiving the light from behind, over the shoulder. Objections to such a layout may be enumerated as follows:

(a) Decided glare upon turning around.

(b) Poor ceiling and general illumination.

(c) Necessity for facing in one direction and inability to use double desks.

(d) Intense and other objectionable shadows caused by persons and objects, especially when moving.

(e) General peculiar appearance.

THIRD.—CEILING CLUSTER FIXTURES.

These are usually installed with bare lamps in an inclined position, the entire cluster being covered by a large reflector. The principal objections to such a layout are as follows:

(a) Glare from lamps.

(b) Poor distribution of light.

(c) Fixtures usually placed without regard to desks, so that clerks may often be working in their own shadows.

(d) Production of regular reflection from highly polished surfaces and writing as mentioned hereinbefore.

FOURTH.—DISTRIBUTED UNIT PLAN.

This system, which has been in quite general use and has been advocated by a number of reflector manufacturers, is to be very greatly commended for its good efficiency and distribution and its adaptability to any form of room. It consists in placing units of lamp and reflector in spaces so laid out with respect to the height of the unit above the working plane and the distribution characteristic of the unit as to produce the distribution of illumination desired. While it may satisfy all conditions of distribution, reduction of brilliancy, ease of control, etc., it still causes the light to travel in certain definite directions, the result of this direct light being direct reflection from highly calendered paper, colored inks and both lead and copying pencil writing.

The best solution, therefore, would appear to be a system which would provide light emanating from all directions, and to be of sufficient intensity for twilight service and of low enough brilliancy so as not to produce a glaring effect during the later hours of darkness. The ultimate aim would be the exact simulation of daylight, which being the condition under which the eye has been developed during the course of ages, is to be considered the ideal. Of such solutions there are but two in use, one of which, in the opinion of the writer, is the more desirable, while at the same time being the more efficient.

The first system is what is known as the total indirect lighting system, and consists in so placing lamps in opaque reflectors that all of the reflected light is directed to the ceiling, from where it is redirected either directly from the ceiling or indirectly by the walls to the working plane. The result is a most pleasing, even illumination produced by light coming in all directions from large surfaces of low intrinsic brilliancy and overcoming all the objections mentioned. The only objections to be noted are:

(a) The low efficiency compared to the direct lighting system, using as a basis the distributed unit system.

(b) The somewhat unnatural and unexpected appearance due to the lack of an apparent light source.

(c) The lack of sufficient shadow and perspective.

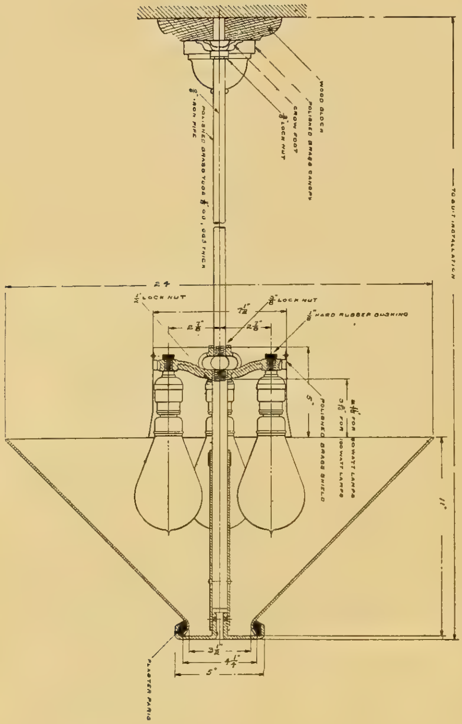


FIG. 1.

(d) The lack of sufficient variation in illumination intensity to provide exercise for the eye muscles and accommodation characteristic of the crystalline lens.

(e) Inability to relax and rest the eye due to the latter objection.

An improvement which the writer believes overcomes, to a great extent, the foregoing objections may be termed a semi-indirect lighting system in which a large proportion of the light is directed to the ceiling, a smaller portion being transmitted and diffused by the reflector which is made of translucent material such as opal glass. In such a system there is not enough direct light to produce glare, heavy or objectionable shadows or bright spots, while the reflector is so large and so good a diffusing medium that no sources of high brilliancy are in the field of vision. In addition, the sense of perspective is maintained and the natural desire to see the location of the source of light is satisfied.

From comparative illumination tests of the three last mentioned systems, the following efficiency values are given:

	Per cent.
Distributed unit system—Holophane reflectors—Tungsten lamps........	100
Semi-indirect system—Conical opal glass reflectors—Tungsten lamps..	65
Total indirect system—Conical metal reflectors, aluminum paint interior finish—Tungsten lamps...........	33

It is evident that in order to obtain the highest efficiency of illumination, the ceiling and walls of the room should be finished in some flat light color in order to reduce any glare from these surfaces and to reflect as large a proportion as possible of the light falling upon them. A dead white would be too light in color for comfort, the best and most comfortable color as determined in a number of trials by the writer being what is known as an old ivory. Care should also be exercised to obtain a reflector which combines the qualities of good interior reflecting surface and good diffusing properties for transmitted light.

Much experimental work to determine the most efficient form of reflector, position of lamps in the reflector, distance of

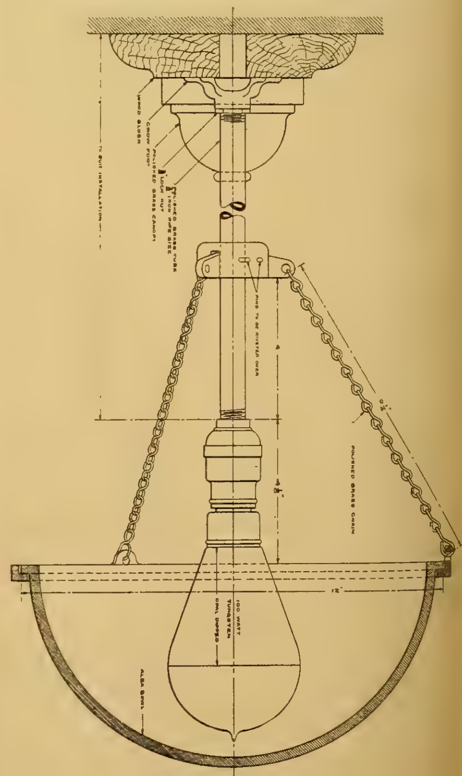


FIG. 2.

lamps from the ceiling and spacing of units, may yet be done to improve this system. As examples, however, of two fixtures already built and used by the writer on one of the large railroads, Figs. 1 and 2 are presented. Electrical control of fixture shown in Fig. 1 may be accomplished by means of a pendant switch if desired. This fixture is applicable to drafting rooms also, and due to the direct light emanating from it, it is available to a certain extent for the purpose of localized lighting. Fig. 2 shows a fixture more elegant in style which may be used for private offices. The railroads, however, do not pretend to be fixture manufacturers nor to manufacture fixtures as elegant in conception and artistic workmanship as the fixture trade could supply. It might, therefore, not be presumption to suggest the idea of semi-indirect lighting fixtures to the manufacturing fraternity as a field to which it might pay well to give some attention.

Lighting Large Areas

By L. J. Auerbacher.

Among the most efficient tools the illuminating engineer now has at his disposal is the simplified form of flaming arc in which the complex mechanism has been eliminated. There has never been any doubt whatever regarding the great efficiency of this illuminant, which is from .2 to .25 watts per candle, but the complicated nature of the mechanism in the first types of lamps imported into this country made the engineer hesitate before recommending them to his client.

Another determent was the uncertain length of burning on one trim, the life varying from normal 17 hours to 10 hours. This wide range of carbon life was due to the fact that the sensitive differential mechanism would not keep the arc in the proper plane of the economizer, where the supply of oxygen was limited, but would allow the carbons to overfeed. The crater would then be in such a position to get a free supply of oxygen, and consequently the carbons would be consumed too rapidly.

A successful effort has been made to develop a lamp in which the arc is always in a fixed position, and in which consequently the life of trim is always at its maximum. This not alone effects a considerable saving in carbons but at the same time enables lamps to be trimmed regularly and burn the night through in the long winter season. In addition to this valuable feature the mechanism has been so simplified that the most careless trimmer cannot put the lamp out of service.

Fig. 1 of the diagram shows the lamp mechanism in which its simplicity is apparent. The operation of the lamp is as follows: When the current is turned on this lamp a series magnet is energized, which operates a pantograph lever and pulls the carbons apart in a parallel position. In the direct current lamp the negative carbon has a rib or projection on one

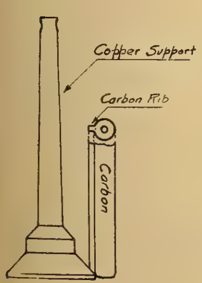


Fig 1

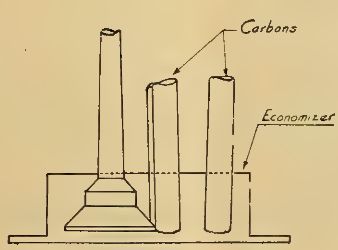


Fig 2

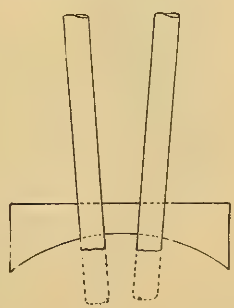


Fig 3.

side which rests on the copper support shown in Fig. 2 of the diagram. The current is fed in at the copper support as well as at the carbon holder, thus cutting out the carbon resistance, and at the same time assisting in burning away the rib support.

The principle underlying this lamp is that the carbon is cooled at a point furthest away from the arc by reason of its resting on the copper support, thereby disintegrating gradually without injury to the support. These carbon supports become charred in time and are renewed every three to six months. They cost only a few cents and are really the safety valve of the lamp, in which the trouble, if any, concentrates. The trimmer can renew one without any difficulty, and lamps unless injured mechanically do not have to go to the shop. Fig. 3 of the diagram illustrates the renewal copper support. A dash pot is attached to the solenoid core to prevent the too rapid pulling apart of the carbons.

FIG. 6.—VIEW SHOWING FLAMING ARC LAMPS USED IN OUTDOOR WORK.

FIG. 4.—A FLAMING ARC LAMP.

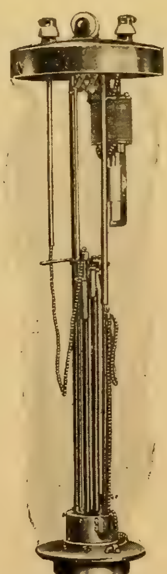


FIG. 5.—VIEW SHOWING MECHANISM OF LAMP.

Naturally such a type of flaming arc opens up further channels of usefulness in the illuminating field and enables the illuminating engineer to make use of this efficient unit for large lighting schemes. Public service corporations in this country have until recently been more or less hostile to the introduction of the flaming arc lamp on their circuits. It no doubt was the complicated nature of the lamp mechanism and not the lamp, as certainly an illuminant which has a higher efficiency than any type was surely not to be so lightly cast aside.

It would pay any electric light company to thoroughly canvass the municipal authorities and merchants' associations and induce them to put more light on the streets. Not alone would the direct revenue be larger, but the indirect results would bring in an increased income. Other outdoor lighting would be stimulated, and by creating larger standards of light an increased demand for all classes of lighting would result.

Private users having large areas to light are now rapidly adapting this simplified type of flaming arc to their needs and rapidly displacing obsolete and inefficient systems. Steel plants and foundries especially have found these large units of yel-

low light particularly applicable to their conditions. High ceilings, combined with a murky atmosphere, usually prevail in this class of plants, and there is no other illuminant so well adapted to efficiently light them. Having a large downward candle power they can be conveniently located above traveling cranes and other obstructions and still give sufficient light on the plane to be illuminated. The wiring cost is small, as a great candle power is concentrated in one outlet of comparatively low wattage.

Another factor which is important is the fact that the yellow rays are stimulating in character, and it has been repeatedly demonstrated that more work can be turned out from a night gang working under these rays than under any other. One large steel mill increased the capacity of the night force at least 10 per cent. by installing yellow flaming arcs. They made careful tests as to this fact and proved it conclusively.

Naturally contractors working on large outdoor work, such as excavations, subways, etc., have generally adopted the flaming arc, and find that they can do as much work at night with this type of lamp as in daylight. The writer has recently installed flaming arcs in some of the tunnels now being driven for the new aqueduct of the City of New York. The contractors were so impressed by the quality of the light that they at once lighted all their tunnels with flaming arcs, finding their working conditions much improved thereby. The lamps are located at the shafts and loading platforms as well as at intervals of 150 ft. in the tunnel, which is 20 ft. high by 17 ft. wide. When a blast is set off the lamp at the loading platform is readily taken down and again put up after the blast is set off. This tunnel lighting scheme proves very valuable in expediting this class of work, which is costly in nature and in which the atmosphere is naturally very foggy. Incandescent lamps heretofore simply "intensified the gloom."

Modern Methods of Show Window Lighting

By Geo. W. Cole.

While illuminating engineering practice still varies in many classes of problems it has been reduced to a standard in the case of show window lighting. That the goods must be lighted so as to bring out their qualities and to attract the attention of the passerby to the fullest extent without the light-sources being seen is now generally accepted as the only proper method of illumination. Having a definite result prescribed the illuminating engineer may confine his work to the adaptation of the means to the end in each particular problem.

The first requisite laid down must not be lost sight of, however—that is to say, to illuminate the goods displayed so as to show their qualities to the greatest possible advantage. This means that the colors must be brought out in their daylight values, unnatural shadows must not distort their shape or form and the intensity of illumination must be sufficient to show them distinctly, but without dazzling brilliancy.

For securing the proper color values the tungsten lamp offers, undoubtedly, the most satisfactory means at the present time. The light of this lamp, when of sufficient intensity, shows even the most delicate tints with their daylight values as nearly as the eye would distinguish under ordinary conditions.

In order that there may be no unnatural dark shadows cast in the wrong direction it is essential that the goods displayed be lighted from both in front and overhead. The ordinary method of accomplishing this end is to place a row of lamps with some sort of opaque reflectors along

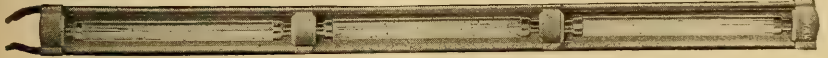


FIG. 1.—SECTION OF LINOLITE SHOW WINDOW REFLECTOR.

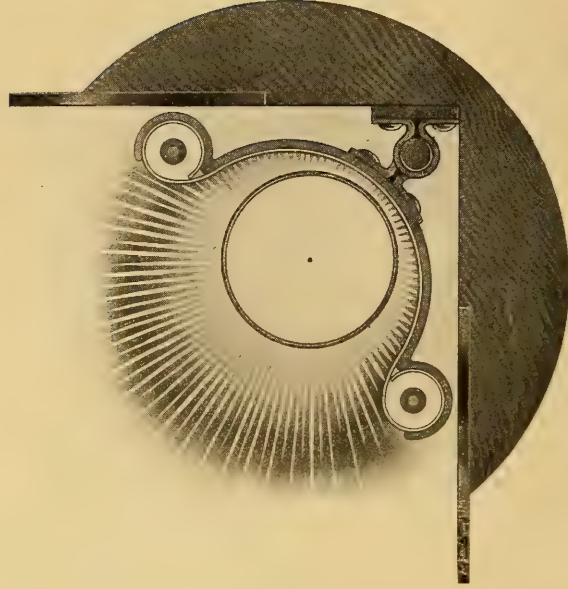


FIG. 2.—CROSS-SECTION OF LAMP AND REFLECTOR.

the upper front corner of the window and project the light downward and slightly backward, so as to cover the floor of the window. While the use of lamps in this position is an indispensable part of any good show window installation it can be improved appreciably by the addition of lights on the vertical sash bars and at the corners. There are not a few cases, especially in windows that were constructed before show window lighting had been reduced to a standard, in which there is insufficient room for the installation of the standard shape of tungsten incandescent lamp and reflector, and the case is rare in which the vertical sash bars are sufficiently wide to permit the use of the older fixtures without either showing the ugly metal reflectors or a row of dazzling bare lamps.

The ideal arrangement of a light-source for this purpose is a continuous luminous surface running the entire length of the window at the top and along each vertical sash bar. Such an arrangement not only affords a form of light that can most readily be handled by reflectors but produces an evenness of illumination which is one of the chief requisites of this class of lighting.

To meet the demand of this as well as many other problems involving more or less similar conditions, a tubular form of incandescent lamp in which the filament extends in a straight line through the center instead of being coiled into a loop has been developed. One of the most apparent advantages of such an arrangement is the compactness of form of which both lamp and reflector are susceptible. As the radiant represents theoretically, and very nearly so practically, a line, and as this is contained in a tube of only 1 in. diameter, it is possible to construct a reflector of very much smaller dimensions that will intercept a given proportion of rays than in the case of the standard form of lamp. The diagram, Fig. 2, shows a section through such a lamp and reflector, and inspection will show that, although the reflector is but 2 in. in diameter, it intercepts a sufficiently large portion of

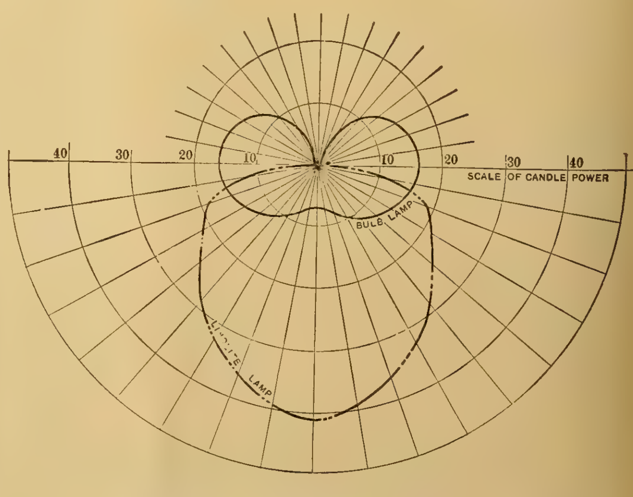


FIG. 3.—CHARACTERISTIC PHOTOMETRIC DISTRIBUTION CURVE OF LINOLITE SHOW WINDOW REFLECTOR UNIT.

FIG. 4.—SHOW WINDOW ILLUMINATION WITH LINOLITE TUNGSTEN LAMPS.

rays to fully meet the demands for this particular case. As a result of this compact construction this system can be readily installed in any window, even where the glass meets the ceiling, since the reflector itself is a continuous strip of metal and wholly unobjectionable, even when fully exposed to view. Furthermore, this system can be installed on vertical sash bars without being either visible or unsightly.

Besides this mechanical advantage this form of lamp possesses the very distinct electrical advantage of being capable of series operation. This means that when a tungsten filament is used a heavy wire can be utilized, thus insuring the long life and high efficiency characteristic of the series lamp. The lamp alone is shown in Fig. 1. As will be readily understood the two poles or contacts are at opposite ends of the tube. The reflector and its holder are of metal, the latter serving as a conduit for the supply wires, so that the system is complete and self-contained.

Fig. 4 shows an installation of this sys-

FIG. 5.—ANOTHER SECTION OF WINDOWS OF THE ABOVE INSTALLATION.

tem in one of the prominent department stores of New York City. The use of the lamps on the vertical sash bars to supplement the overhead illumination is one of the notable features of this installation. The results show for themselves. Fig. 5 is a view of another part of the same installation at closer range, which shows the evenness of illumination and general effectiveness of this method of lighting.

The windows are divided into sections 12 ft. square—*i.e.*, they are 12 ft. high, with vertical sash bars 12 ft. apart. The floor space within is 8 ft. wide. Four hundred linear ft. of lighting units are used in the installation. As each foot contains one 25-watt Linolite tungsten lamp the total consumption of current is 10 kilowatts.

"In the Palace of the King"

Electricity and gas have provided the means of producing single light-sources so far surpassing anything known before as to make comparisons ridiculous. But when it comes to domestic illumination, the ancient candle still holds its place undimmed by the glare of modern illuminants. Tangible evidence of this is everywhere to be found in imitative forms of this pristine light; and even a modern lighting fixture is commonly designated as a "chandelier."

The established order of things changes less rapidly in the Orient, and here is still to be found the candle in all its glory as an actual illuminant. The illustration on the front cover of this issue shows the vestibule in the Dolma-Bahtche palace in Constantinople, one of the imperial palaces of Turkey. The two candelabra shown are probably unsurpassed in magnificence by any in the world. The bases are of alabaster and the superstructure of glass, as shown. Where is the modern electrician that will undertake to surpass in beauty the illumination here produced by this ancient and honorable light? In two respects, however, which particularly appeal to Western civilization, modern light-sources excel—in convenience and cost. As neither of these come into the reckoning of the Eastern ruler or potentate, the candle may be expected to retain its place undisturbed in his palaces.

To the tone of being a century behind the times in the character of the luminants used, the Sultan might readily reply that the lighting of his palace at least has the virtue of sincerity, that it is exactly what it professes to be, and not an imitation and a sham, and if he should further pursue the subject by starting to point out examples in our country on the boasted progress of the crude imitations of the candle by electric light, we should have to admit his argument in sheer despair; the preponderance of evidence would be overwhelming.

As gas and electricity have added to the quantity rather than the quality of illumination, so have many of our modern inventions and improvements tended to elaborate rather than to refine and embellish our labors and pleasures. It was long ago said that "no man by taking thought can add a cubit to his stature," and the present condition of Western civilization shows that all the thought taken to unravel the mysteries of nature and to turn her forces to practical account have added nothing to the moral or spiritual stature of man. Beauty, truth, and conscience have remained unchanged amid all the marvelous discoveries of science.

The New Street Lighting in Washington

By Walter C. Allen.

The lighting of Sixteenth street, one of the most prominent in the residence section of the District of Columbia, has recently been greatly improved in connection with the extension of that thoroughfare and the opening of the new Piney Branch Bridge, which carries it across a deep run. This broad highway leads directly north from Lafayette Park in front of the White House to and along the eastern boundary of Rock Creek Park, and is adorned by the homes of statesmen and wealthy residents and the embassies of several foreign countries.

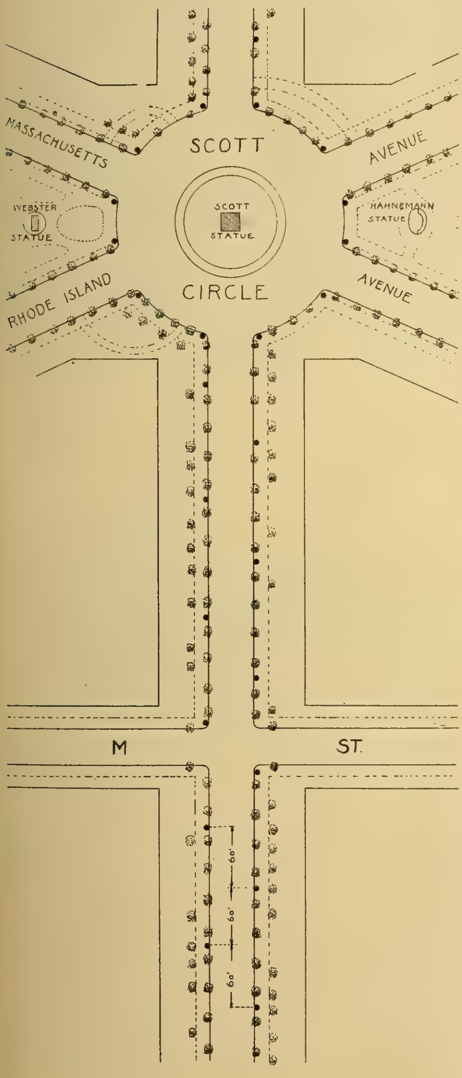


FIG. 1.—PLAN OF SCOTT CIRCLE AND PORTION OF SIXTEENTH STREET, SHOWING TYPICAL ARRANGEMENT OF LAMPS.

It is 160 ft. wide between buildings, with a central 50-ft. roadway and a 15-ft. sidewalk and a 40-ft. parking space on each side. For a portion of the distance there are four rows of trees, one at each curb and one at the inner line of each sidewalk. On the center line of the street, where it is intersected by Massachusetts and Rhode Island avenues, the equestrian statue of General Scott is placed, flanked by the statues of Daniel Webster and Dr. Hahnemann (see Fig. 1).

The old form of lighting consisted of mantle gas lamps, spaced from 150 to 200 ft. apart. These lamps have been abandoned and replaced by tungsten street series lamps, with especially designed posts spaced, on the average, 60 ft. apart, measured on the axis of the street.

The lamps are suspended tip downward in a 15-in. ground glass globe, the center of which is 10 ft. 3 in. from the sidewalk (see Fig. 2). The bent pipe serving as a support for the lamp and its socket is turned towards the houses.

The method adopted in the installation of the tungsten lamps in Riverside Drive, New York, has been followed in this instance. Where there were no conduits of the electric lighting company already constructed, a steel armored cable (Fig. 3) was laid on the inner side of the granite curb, where the projecting concrete base would protect it from damage in the manner indicated in Fig. 4. At the street crossings the cable is carried under the roadway in a terra cotta conduit.

The total distance covered by this improved lighting is 2½ miles. Over the first mile, where the foliage is extremely

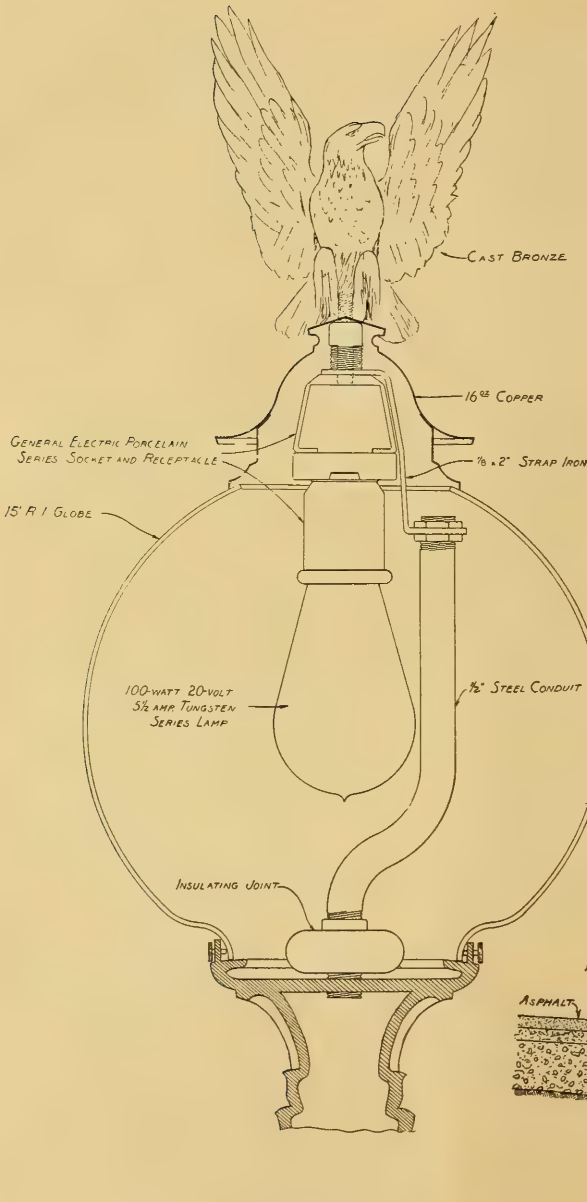


FIG. 2.—METHOD OF SUSPENDING LAMP.

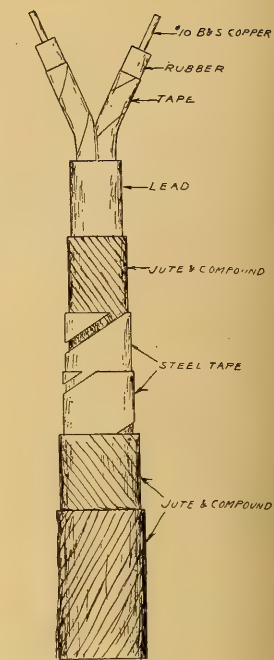


FIG. 3.—SECTION OF ARMORED CABLE.

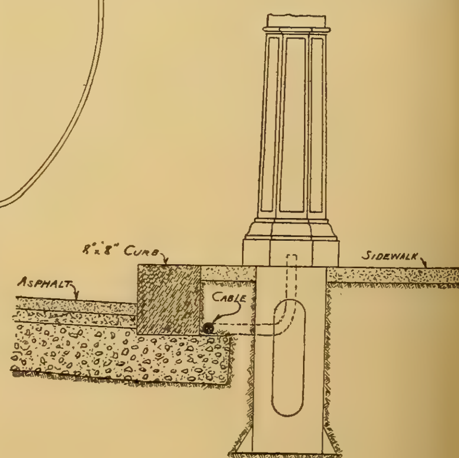


FIG. 4.

dense (see Fig. 5) and the travel heavy, 80 candle-power (100 watts) lamps are used, while over the remaining portion, less traveled at night and with only one row of trees on each side of the street (see Fig. 6), 40 candle-power (50 watt) lamps are installed, the spacing of the posts being the same in each case.

Two styles of posts are used: one shown in Fig. 7 on street corners having a square open frame to hold the street signs, which are of ruby glass with white letters; the other shown in Fig. 8 for the intermediate lamps. The ground glass globe so diffuses the light that the inner surface of the street signs is illuminated, making it easy to read the names at night. Fig. 7 shows how legible the signs are in

FIG. 5.—VIEW OF SIXTEENTH STREET, LOOKING NORTH FROM LAFAYETTE PARK, SHOWING FOUR ROWS OF TREES.

FIG. 6.—VIEW OF SIXTEENTH STREET, 1½ MILES NORTH OF LAFAYETTE PARK. FRENCH EMBASSY IN FOREGROUND. RESIDENCE OF SECRETARY MACVEAGH AND EMBASSIES OF SWEDEN AND DENMARK BEYOND.

FIG. 7.—CAST IRON LAMPPOST WITH STREET SIGN.

FIG. 9.—LAMPPOST WITH CAST IRON STREET SIGN AND RAISED LETTERS.

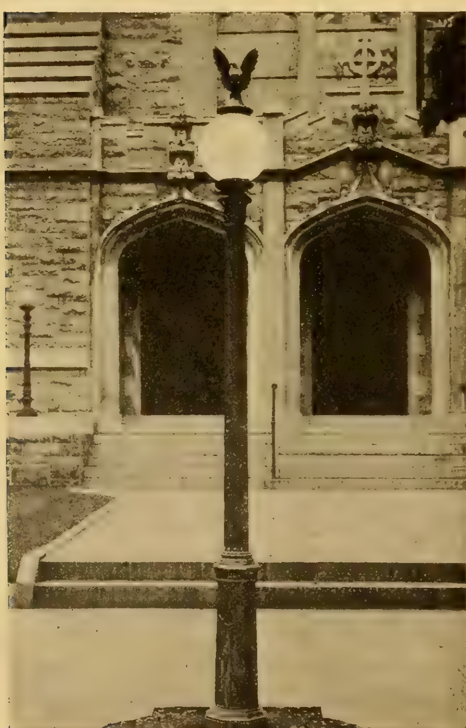


FIG. 8.—CAST IRON LAMPPOST, BRONZE EAGLE.

FIG. 10.—CAST IRON LAMPPOST, PINEY BRANCH BRIDGE.

FIG. 11.—VIEW LOOKING SOUTH FROM PINEY BRANCH BRIDGE.

the daytime. For the designation of the streets and avenues intersecting at Scott Circle, where the angles are not right angles, it is proposed to use cast iron plates with cast raised letters, the latter outlined with gold leaf, similar to those now in use in the Union Station Plaza in this city (see Fig. 9).

The new Piney Branch Bridge, the northern terminus of the present lighting, is a beautiful concrete structure with a single span of 125 ft., a height of 62 ft. above the stream on the center line of the arch and a total length of 272 ft. It is illuminated at present by 12 80 candle-power (100 watt) tungsten lamps, three to each of the ornate cast iron posts shown in Fig. 10. The central globe is 24 in. and the smaller globes 17 in. in diameter, the center of the former being 20 ft. above the pavement. The posts are 160 ft. apart. Four massive bronze tigers are to be placed on the pedestals at the entrances to the bridge.

The Lighting Requirements of Airships

By Frank B. Rae, Jr.

The lighting requirements of airships constitute a phase of illuminating engineering which has not received much attention in the past; in fact, the writer does not recall having seen anything upon the subject in print. That the matter is one that will stand profound study, however, will be vouched for by at least two men who have lately completed such an installation—the writer and Mr. B. F. Whelan, of the Buckeye Electric Company of Cleveland.

The airship upon which we worked was the Wellman-Vaniman dirigible *America,* which has just been completed at Atlantic City, N. J., for an attempt at the transatlantic passage. She is a huge affair, 228 ft. long, 345,000 cu. ft. volume, 24,000 lb. lifting capacity, 170 horsepower, and can log off 26 miles per hour in a calm. Suspended from the gas bag is the nacelle, or car, 156 ft. in length, composed of steel tubing and supplied with a protecting canvas cover. Within this nacelle are the navigator's instruments, log, engines, dynamo, switchboard and equipment for taking observations and keeping scientific records, arranged the length of the car from bow to stern in the order named. Beneath the car is suspended a life-boat of special design, which is used as the cabin for the wireless operator.

The lighting of the *America* was a

problem rather in electrical than in illuminating engineering, for the steel frame of the car is used as the aerial of the wireless outfit, which circumstance made the matter of insulation one to conjure with. Also, the uncertainty of the engines made it necessary to allow for shifting the generator from one prime mover to another, which was something of a "stunt"; and finally, it was necessary to figure upon the breakdown of practically every separate part of the system and to provide for the safe and continuous operation of the remainder.

The equipment for the lighting of this, the first airship to attempt the transatlantic voyage, consists of a ¼ kw. generator, a 12-cell accumulator, a complete switchboard in the "engine room," and instruments to note battery discharge in the wireless cabin, eight tungsten lamps and steel reflectors. This equipment was arranged as shown in the accompanying simplified diagram of the nacelle and lifeboat. The entire lighting problem centered about the word "efficiency," as can well be understood. It was imperative to secure an abundance of illumination, especially about the engines, but it was equally imperative that the minimum current be used and the minimum weight be carried.

Beginning our description of the outfit with the dynamo, this is so shipped that it may be moved readily from one engine to another and connected for service without delay, an arrangement made necessary by the fact that none of the three engines can be depended upon for continuous service and because it may become

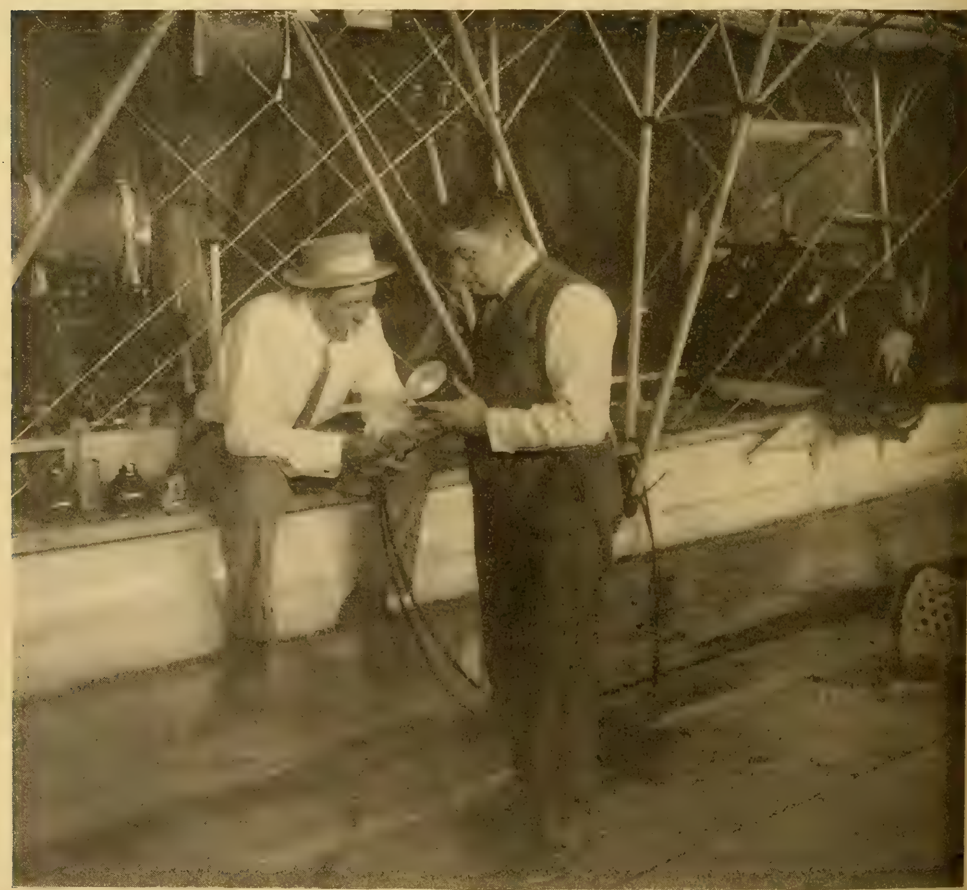


FIG. 1.—B. F. WHALEN OF THE BUCKEYE ELECTRIC COMPANY AND J. R. IRWIN, THE MARCONI WIRELESS OPERATOR, WHO WILL ACCOMPANY THE AIRSHIP "AMERICA" ON HER TRANSATLANTIC FLIGHT.

imperative to operate the Marconi direct from the generator. The circuits and insulation needful to this flexibility cost the designers of the system no little trouble, but the final tests proved entirely satisfactory.

The batteries are located in the forward compartment of the lifeboat, where also is located the wireless apparatus. The 12-cell battery could doubtless be depended upon alone were there any certainty as to the duration of the transatlantic trip, but in view of uncertainty the charging machines are carried. The wireless outfit is operated in multiple with the lamps. This apparatus requires about 250 watts, but in view of the heavy conductors it was not thought that this load would cause any serious fluctuation of the light, and tests proved that our theory was correct.

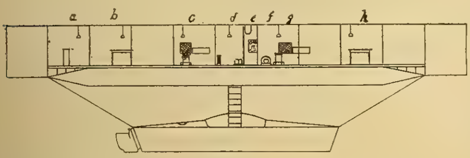


FIG. 2.

Diagram showing the positions of the apparatus and lighting units aboard the Wellman-Vaniman transatlantic airship *America:* (*a*) binnacle; (*b*) table where the log is kept; (*c*) main engine for driving propellers; (*d*) service engine for driving airpump, winches, etc.; (*e*) switchboard; (*f*) dynamo; (*g*) secondary engine for driving propellers and dynamo; (*h*) table where instruments are kept and observations recorded; (*j*) lifeboat in which wireless operator is stationed.

Eight 20-volt, 25-watt tungsten lamps with steel reflectors, are the lighting units. The lamps are burned over voltage to give more brilliant illumination and the reflectors chosen were of the type to concentrate the light closely upon the working parts of the engines and the instrument cases. Of course the lamps will be used as little as possible, but when light is needed it will be needed badly and must be adequate for any contingency.

The lights required are as follows: One in the binnacle to illumine the compass face, one over the log, which is kept just back of the navigator's stand, one each over the three motors, one in the stern, where the various instruments for observation and the scientific records are kept, and one in the lifeboat or wireless station. Besides these a simple signalling flasher is required by the wireless operator for short-range communication or emergency use, and a couple of hand lamps are provided for the mechanicians in charge of the motors. All hands will also carry pocket battery flashers against possible breakdown of the system.

The illumination as planned is ample for any possible contingency. The positions of the lamps and use of intensive steel reflectors protect the eyes from all glare while giving an illumination intensity of approximately 3½ foot-candles on the working planes.

Fixtures and Accessories

Illuminating Glassware: Its Relation to Lighting Fixtures

CHAPTER III.

BY E. LEAVENWORTH ELLIOTT.

Cutting, of a character similar to that used on tableware, is sometimes employed as a means of decoration for illuminating glassware. There is little to commend it. In theory, and generally in practice, it is a perversion that too plainly declares itself. Cut glass owes its beauty entirely to the prismatic colors produced by the dispersion of light at the prismatic surfaces, and this dispersion, or spreading of the light into the spectrum colors, results mostly from reflection. This fact is taken advantage of in the manufacture of artificial diamonds, which are simply pieces of highly refractive glass faceted after the manner of the real gem, but silvered on the back so as to reflect the light. It is evident that lighting glassware, in which the light is placed within, can show very little of this prismatic effect, and hence the cutting fails of its purpose. Beside this failure, it breaks the luminous surface up into a shapeless mass of streaks and spots, which are of dazzling brilliancy. The most legitimate use of cutting on lighting glassware is to relieve the plainness of an etched or frosted surface; and when sparingly used in a sufficiently simple design, is admissible. The elaborate cut bowl used as a lamp globe is of the same order of art as a lamp shade used as a fruit dish. Decorative art must have a keen regard for the eternal fitness of things.

The use of color in illuminating glassware, either in the body of the glass or superficially applied, constitutes almost an art in itself. That its use is not only legitimate but capable of producing the highest artistic effects will be at once admitted. That it offers equal opportunities for transgression of both the canons of good art and the principles of illuminating engineering is likewise apparent. We may observe that the use of color in this case is strictly decorative, it possessing no utilitarian advantages. The extent of its use, therefore, must be decided in the first instance by the extent to which utility may be sacrificed to beauty. The limits to this condition are wide, and the use of color likewise varies through a correspondingly wide range. From the globe that is given a slight amber or yellow tint to soften the light, to the art glass or heavily-stained dome, there is a span wide enough to include an infinite variety of color schemes. The detailed consideration of this subject will be taken up later.

Composite glass globes, that is, those made up of beads or jewels, form a separate class by themselves. The effect produced is very distinctive and is entirely different from that of solid globes cut only on the outside. As the beads or jewels of which they are composed can be cut on all sides, it is possible to secure a play of prismatic colors comparable to that produced in the familiar cut glass tableware. The multiple reflections and refractions thus produced also generally quite obscure the form of the radiant within, and so remove the objection to plain cutting. From the purely decorative standpoint such globes unquestionably possess much merit. The fact must not

be lost sight of, however, that they give an astonishingly large amount of absorption, and providing for their use this must be taken carefully into account in order that the required amount of illumination may be obtained.

Of other translucent materials than glass three are more or less used, namely: mica, shell and alabaster. Mica is used in globes of the lantern form in reproductions of mediaeval fixtures. Its use must be regarded as strictly for artistic purposes, as it serves no useful purpose whatever, and absorbs light to an extent that would be scarcely believable from its apparent transparency. When using it in fixture design, therefore, care should be taken to allow for this reduction in illuminating efficiency.

It is a question of personal taste as to which is the more beautiful material for a translucent globe, polished shell or carved alabaster. The former is suitable only when it is to be viewed at comparatively close range, as on table lamps or brackets. For such purposes there is nothing quite so exquisite, either by transmitted or reflected light. In efficiency it may be compared with dense opal glass.

The use of alabaster is confined to bowls for ceiling suspension, and for this purpose is without a peer in the whole realm of illuminating globes, from the artistic standpoint. When illuminated it seems to glow with its own light rather than to transmit the light from within, which gives it an indescribable beauty. Its most effective use is for semi-indirect lighting, which is accomplished by leaving the top of the bowl open and suspending it near enough to a white or light-tinted ceiling to make it useful as a reflector.

The shape, or contour, of lighting glassware is a matter which affects both the engineering and artistic sides of the problem. A transmitting globe always changes the distribution curve to some extent, depending upon the character of the material and the nature of the surfaces. The general effect of a diffusing globe, where the diffusion is produced by opalescing the glass or roughening the surface, is to bring the curve nearer to a circle. The effect is greatest with a spherical globe having the highest co-efficient of diffusion. Dense opal glass, therefore, will produce the maximum effect of this kind. In the case of arc lamps and upright gas burners in which there are mechanical parts below the light-source which cast shadows, the use of a diffusing globe gives a sufficient change of curve to entirely remove these shadows. With globes of other than spherical form, and with variable diffusing power on different parts of the surface, the change in curve will depend upon these special conditions.

In the case of reflectors the contour naturally has much more to do with the change in distribution. In this respect reflectors may be distinctly divided into two classes: diffusing, and mirror, or regular, reflectors. To the former belong all roughened and white surfaces, such as brush-finished metal, opal glass, and enameled metal; to the latter belong silvered and prismatic glass.

All diffusing surfaces have some direct reflection, and consequently the contour of diffusing reflectors varies the distribution curve to some extent. In the case of plain opal glass and enameled steel the amount of regular reflection is considerable, and consequently the distribution curve may be varied to a corresponding extent by the shape of the reflector. With roughened opal and brushed aluminum the shape of the reflector has comparatively little effect.

Prismatic glass is equivalent to a plain mirror surface, hence the distribution curve conforms very closely to the shape of the reflector. Frosting or etching either surface of prismatic reflectors of course destroys the regular reflection, and hence changes the distribution curve as well as the reflecting power.

It is well to again call attention to the fact that the distribution curve given by a perfectly diffusing reflector is independent of its shape or contour, hence all efforts at predetermining the distribution curve by the laws of regular reflection are entirely futile if a diffusing surface is to be used.

For general illumination, especially of larger spaces, the form of distribution curve obtainable by reflectors on actual light-sources is of practically little account. It makes no difference in the results whether the illumination on a given

point is produced by the single unit placed nearest to it, or is the result of a hundred different units at different distances. The larger the area to be lighted, the less the distribution curve has to do with the final result. The important things in such cases is not the distribution curve, but the co-efficients of reflection and absorption, and a contour that will eliminate direct vision of the radiant to the greatest possible extent. As a deep reflector accomplishes the latter purpose to the greatest extent it is preferable to the shallow or flared forms, other things being approximately equal.

Regular or mirror reflectors are preferable where a definite small area is to be lighted, as a show window, and may be used for general illumination where the eye will not encounter the reflecting surface direct. To expose the inside of a regular or mirror reflector to direct vision is only an aggravation of the evil effects of the direct glare of the radiant.

There is a general erroneous belief that mirror reflectors are the most efficient. This is the natural result of their giving images which have apparently the same brilliancy as the light-source. In fact, however, pure white diffusing surfaces have an efficiency equal to ordinary silvered glass. Furthermore, the fact must not be lost sight of that translucent diffusing reflectors such as opal glass, besides having a high co-efficient of reflection, transmit a large portion of the light that is not reflected, such light being useful for the illumination of ceilings and the space above the reflector. The actual absorption by the best reflectors of this class when used with tungsten lamps runs as low as 3 per cent.

To summarize on the shape or contour from the engineering standpoint: transmitting globes may take any shape to suit the artistic requirements without appreciable effect upon the illuminating results. Reflectors having regular mirror surfaces must have their contour determined by the form of distribution desired. Diffusing reflectors should give as much protection as possible to the eye from the direct view of the radiant, otherwise they can be shaped to meet artistic requirements.

Considered purely from the artistic side there is a great variety of illuminating glassware to which the common names of "globe" or "shade" is applied, and in which the decorative feature is the first consideration, diffusion or reflection being incidental. Variations of this type are numbered by the thousands and change continually with varying tastes and styles in architecture and interior decorations. Any classification of such glassware would, therefore, be made to designate different schools or periods of decorative art. The efforts of the manufacturer of this description of illuminating glassware is constantly directed toward adapting designs to the prevailing taste in decorative art. Generally speaking, the glass manufacturer and the fixture maker work independently, although in the case of fixtures designed especially for a particular building or room the glassware is often treated as a part of the fixture and given a special design to correspond. As such fixtures comprise a small proportion of the total number made, so the specially designed glassware forms a correspondingly small part of the general lines put out by the manufacturers.

The general methods of treatment both in design and workmanship of decorative illuminating glassware have persisted to a much greater extent than the designs of lighting fixtures. This is undoubtedly due to the fact that there was originally a more genuine basis of art in glass than in the metal work. The majority of lighting fixtures made 30 or 40 years ago were monumental atrocities from the artistic standpoint. In this respect, however, they were a fitting complement to the gingerbread motives of architecture that flourished at the time.

The art of etching and cutting glass was brought to great perfection years ago, and when applied to lighting glassware the results were not only inoffensive but distinctly decorative. Aside from a slightly better quality of glass and more artistic shapes, or perhaps we should say shapes conforming to modern schools of decoration to a greater extent, glassware of this kind to-day does not excel that produced 30 or 40 years ago.

Some New Effects in Combination Fixtures

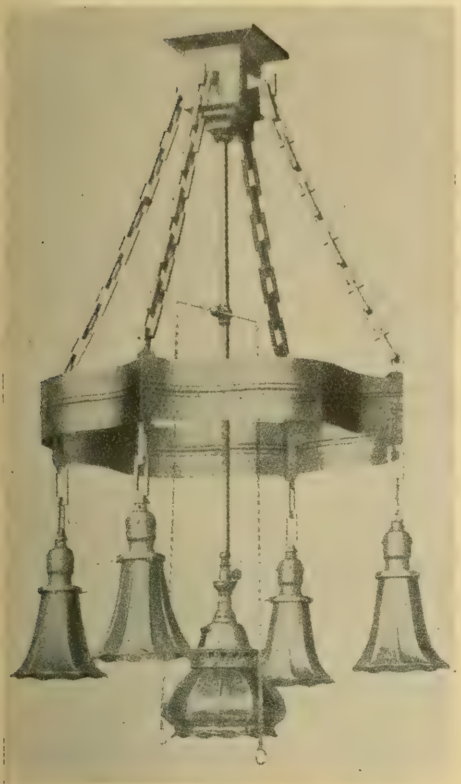


FIG. 1.

There is no doubt that, since its advent more than a quarter of a century ago, the incandescent electric lamp has furnished the chief motive and inspiration to the fixture designer in his efforts at original work. Where gas has been required in combination it has been treated rather as a necessary evil than as a co-partner in the work of artistic creation. The "combination fixture" has, therefore, steadily declined by reason of this neglect, and generally fallen into a state of senile decay. In the earlier days of electric lighting, gas was generally retained as a safeguard in case of failure of electric current, an event which not infrequently occurred; but with the perfection of the means of generating and distributing current the supply to-day is in most cases practically as reliable as the supply of gas, and consequently this precaution is unnecessary.

The development of the inverted gas lamp and its adaptation to American conditions has introduced a new element of life into the design of both "combination" and "straight gas" fixtures, which is already beginning to bear fruit. The difficulty of obtaining lighting fixtures for gas that were comparable in originality and artistic conception to those designed

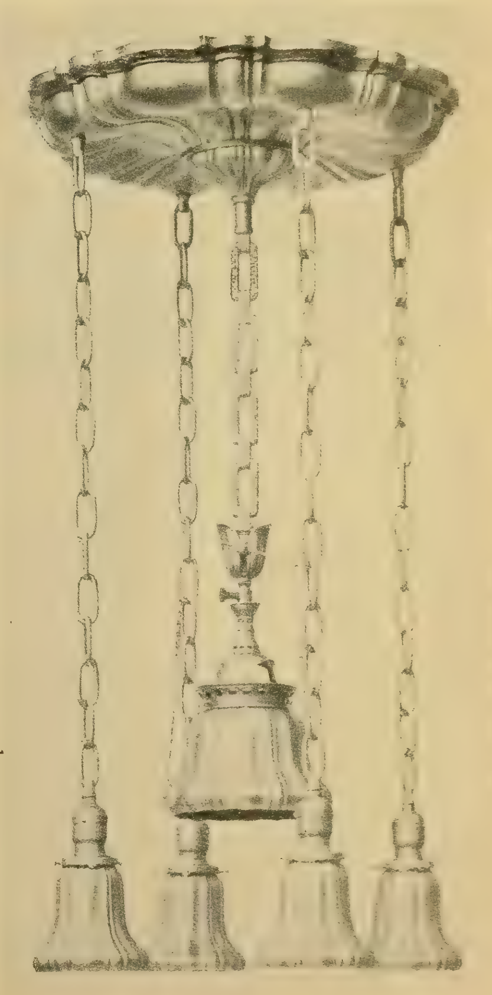


FIG. 2.

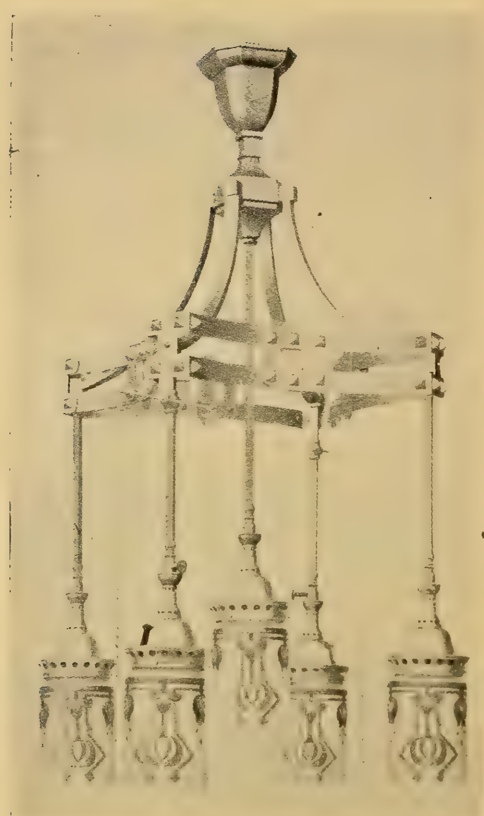


FIG. 3.

for electricity had at last reached such an acute stage that even the gas companies began to take cognizance of the fact. Within the past two years very considerable effort has been made on the part of the gas lamp manufacturers to meet this unseemly condition.

We have always maintained that the upright mantle burner was susceptible of artistic effects equal in most cases to those obtainable by the electric light, a claim which is substantiated by the work of foreign fixture manufacturers. Why this very efficient and satisfactory unit has never been so treated in America is a question whose answer is not now of vital importance. The fact is that the inverted burner has by its novelty, if nothing else, injected a new element of life into gas lighting in general and fixture design in particular.

A recent catalogue issued by a Western fixture house shows some very commendable and pleasing results in the introduction of this new element into fixture design, and shows what may be done in this direction when an effort is made by a genuine desire to utilize this new unit to its full extent.

Fig. 1 shows a type of fixture which has rightly achieved wide popularity within the past few years. This type represents a successful effort to get away from the conventional central support, branching arm design which has dominated fixture construction from time immemorial. The design shown is exceedingly simple, but the few elements contained are so well chosen for both harmony and individual elegance that the total effect is very pleasing. The central light is an inverted gas burner, which is differentiated from the electric lamps by a suitable modification of the contour of the globe. The glassware should be particularly noted in this fixture as in excellent harmony with the

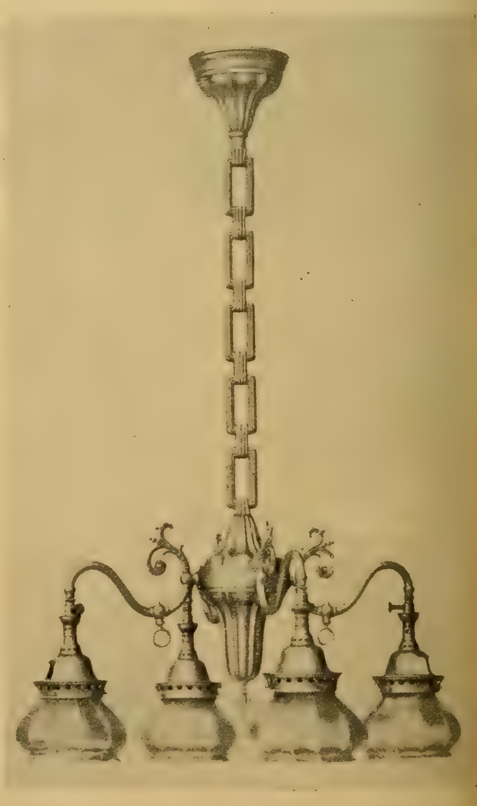


FIG. 4.

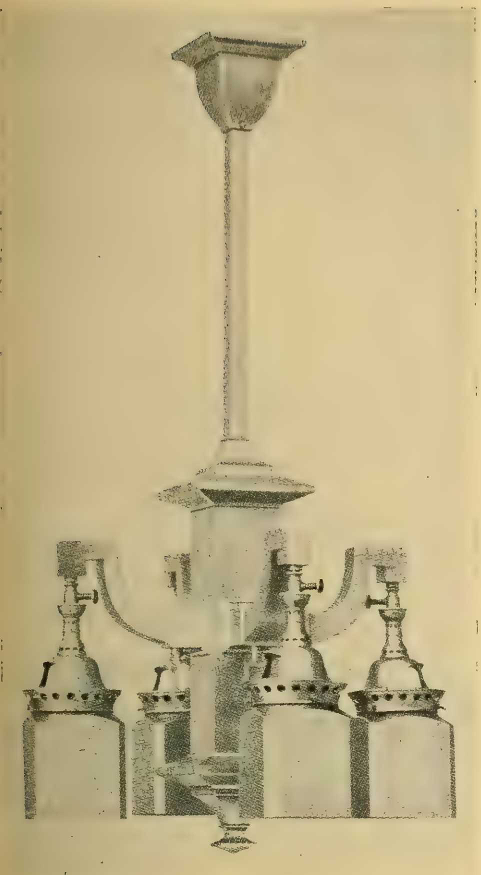


FIG. 5.

general design. Notwithstanding our championship of the upright burner, we must admit that the inverted burner has made possible the use of gas in this new type of fixture, which would be quite out of the question with the older form.

Fig. 2 shows a still further departure from conventional gas fixture construction, the central inverted gas lamp being supported by a chain, or what appears to be such. The one great advantage of the electric lamp in fixture design is its ability to use a flexible support, thus avoiding the stiffness incident to tubes. The chain effect shown here, while not in fact flexible, is apparently so, which fulfills the artistic condition as well as if it were mechanically a chain. The so-called "Sheffield fluting" of the ceiling plaque is carried out in the glassware, and while this furnishes practically the entire decorative scheme, the effect is decidedly artistic and happily free from any suggestion of overdressing or superfluous ornamentation.

Fig. 3 presents several noteworthy points. The use of the angular element in construction has been carried out with exceptional success, the curves introduced being simple arcs of circles and relieving the stiffness of the angular element without suggesting incongruity. All of the parts have an ostensible structural use. The gas lamps here are placed at diagonally opposite corners of the fixture, and are provided with gas cocks with chain pulls. The shape and decoration of the globes harmoniously carries out the spirit of the design. A noteworthy characteristic of this fixture is the fact that the electric fittings have been made to harmonize with the gas, the sockets being covered with a canopy and shade holder of exactly the same pattern as that of the inverted gas lamps.

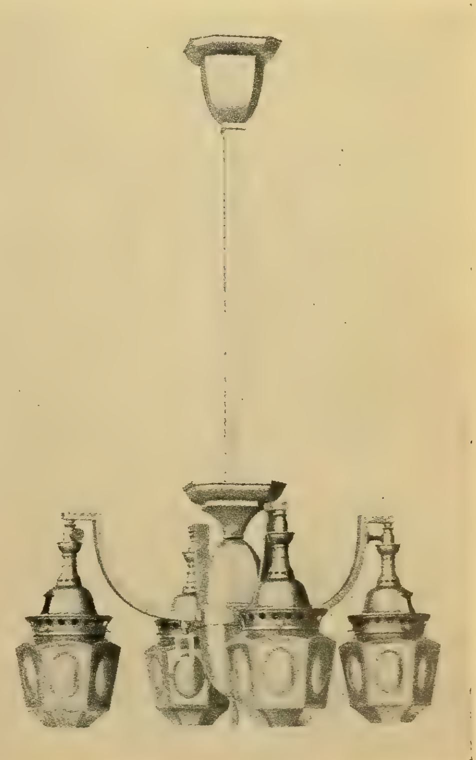


FIG. 6.

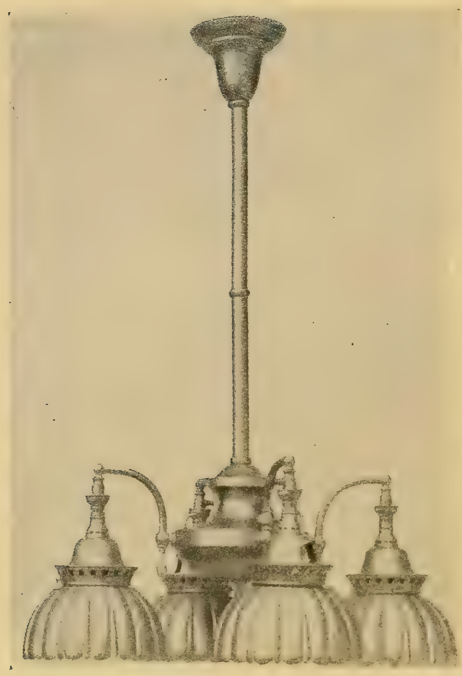


FIG. 7.

Fig. 4 is a simple design combining the inverted gas lamp with the electric lamp in the ordinary central support type of fixture, but using the chain suspension in place of the solid tube. The electric lamps, as in the previous example, are fitted with shade holders to correspond with the gas lamps.

Fig. 5 is a variation of the so-called "Mission" type of fixture, which has been much in evidence for a number of years past, the variation consisting in the curved arm, which, while retaining sufficient angular effect to harmonize with the general construction, gives a welcome relief from the excessive stiffness of construction characteristic of this type. The "boxy" effect of a square shade has also been modified by chamfering the corners. This is a straight gas fixture.

Fig. 6 shows a still further divergence from the square construction. The arms in this case are less massive, and the softening of angles by chamfering the corners is still further carried out. The combination of gas and electric lamps here, as in the previous cases, does not offer the slightest element of discord.

Fig. 7 is notable for the simplicity of design and the harmony of curves in both metal and glass. Like well chosen and sensible style in dress, a fixture of this type will continue to please, no matter what new fashions may be introduced in the fixture design. Harmony can never be made inharmonious by the fickle fancies of fashion. It would be instructive to compare this fixture with some of the atrocities

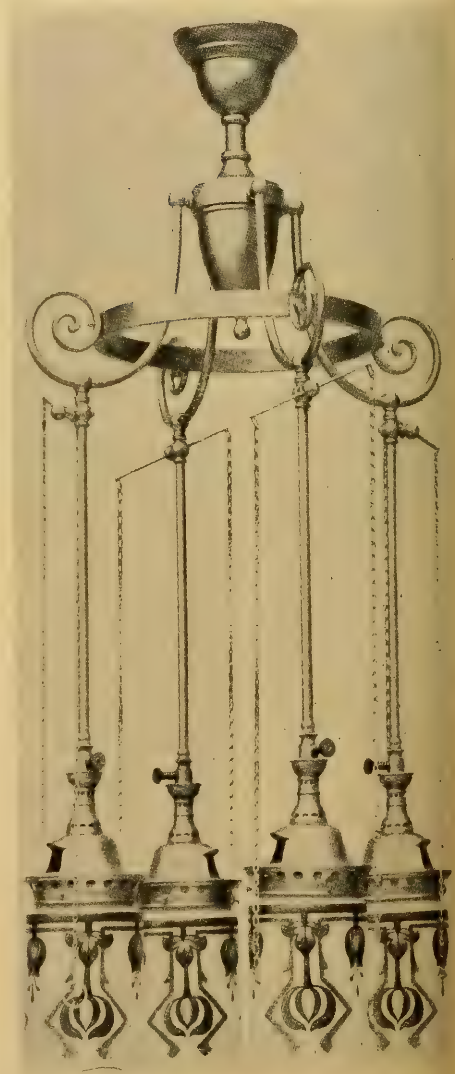


FIG. 8.

that were common about 30 years ago, and mark the progress in public taste thus shown.

Fig. 8 is a straight gas fixture of the "shower" type, each lamp being supplied with a chain-pull gas cock. Apparently no effort has been made to utilize this device as an artistic element, the simplest possible means being used—viz., a straight rod with simple stamped chains ending with a plain ring. The straight rod might well be replaced with a suitable curve and a chain with a decorative link used in place of the stamped chain, which is rather suggestive of more plebian uses. A decorative handle in place of the ring is also an easy possibility. There is no mechanical element of construction that is incapable of artistic effect if the proper effort is made.

Indirect Lighting and the Fixture Industry

Self-preservation is the first law of Nature: this axiom applies to business as well as to physical existence. No trade, vocation or profession can ever be expected to look with favor on any innovation that threatens to either impair or extinguish its existence. To this truth may be attributed the suspicion which led to more or less open hostility on the part of the fixture industry to illuminating engineering. Industry does not like to be disturbed, even though a disturbance may mean improved conditions; the eternal tariff agitation bears ample evidence of this fact. Illuminating engineers, while criticising results and often, either directly or by implication, the methods used to secure them, have steadily maintained that the rise of their profession was in no sense a menace to the prosperity of the fixture industry. That it meant change of conditions there could be no dispute, but that the change would be for the better was argued on perfectly logical grounds.

One of the most notable innovations in lighting which has grown up with illuminating engineering is what is now termed the indirect method. In the first efforts along this line the light-sources were generally concealed behind cornices and the cove utilized for the reflecting surface. As this arrangement required no visible fixtures whatever, its use entirely eliminated the fixture manufacturer; and, needless to say, the merits of indirect lighting did not at first appeal to this branch of the lighting industry.

The application of this method, however, was found not only to be limited, if even approximately satisfactory results were to be obtained, but lacked at least two essential elements for sound illuminating engineering practice—the entire removal of a visible source of light and the impossibility of either illuminating the ceiling with sufficient uniformity or affording the necessary general illumination without excessive cost. The removal of these two serious objections became a necessity if the admittedly desirable features of the indirect system of lighting were to become practically and commercially valuable.

The problem has been solved by the introduction of special lighting fixtures

FIG. 1.

FIG. 2.

which take the place of the old style direct lighting chandelier. With the introduction of this improvement the objection of the fixture industry to this method of lighting has naturally experienced a complete reversal. Not only is the necessity for fixtures retained but the novelty of the method affords a large field for creative ability on the manufacturer's part. That the modern method of indirect lighting not only affords such an opportunity but that very successful efforts have already been made was indicated in a previous article in this department.

Additional examples will not be without interest. Fig. 1 is a rather severe design which will harmonize with a variety of architectural treatments. It is intended for use with the large tungsten lamps—250 and 400 watts.

Fig. 2 is an ornate and distinctly classical design. The material is a composition which may be given any desired finish. The indirect lighting fixture of this type offers a solution of the problem of electrically lighting to interiors of strictly classical design. As the form of the light-source is entirely hidden the anachronism of the modern electric lamp in the presence of classical architecture is wholly obviated. At the same time the fixture affords the necessary visible source of light supply, suggesting a bowl or vase overflowing with light.

The sponsors for this system of illumination positively disclaim any intent or purpose to invade the preserves of the fixture manufacturer. Their efforts in this direction thus far have been merely by way of demonstrating the possibilities of decorative treatment.

Indirect lighting is a system, and those who are promoting it are not manufacturers, but constructing illuminating engineers, and their work is rather in creating a new and profitable field for the fixture industry than in supplanting or competing with it.

The Conservation of Vision

A Prime Necessity in the Movement for the Conservation of the Human Resources of the Nation

Taking the particularly suggestive title above given, Dr. F. Park Lewis, of Buffalo, presented a paper at the last meeting of the National Educational Association, in which he dealt particularly the effect of reading upon the eyes of school children. The appearance of this paper is especially gratifying to the illuminating engineering profession, not only as evidence of a growing appreciation of the importance of the subject, but as a clear and impressive warning against dangerous practices that are now prevalent.

Dr. Lewis repeats the statement so often made by those who have had occasion to observe conditions, that "we are rapidly becoming a bespectacled nation", and attributes the fact largely to the overstrain of the eyes occasioned by the excessive amount of reading done, especially by the younger pupils in the schools, and also to the evil effects of glossy paper and poor printing common at the present time.

The conservation of vision is an extremely broad subject; in fact, it is so broad that it covers by far the larger part of the entire field of illuminating engineering. Dr. Lewis has taken up one of its most important divisions—perhaps the most important, and has struck at one of the chief roots of a most serious evil. His appeal for a limitation of the hours of study and reading of school pupils is well worth heeding. He says:

"The labor unions have wisely limited the working day to eight hours for strong men whose body tissues are developed and resistant, while we compel the child at the formative period of his life to use his most vital and impressionable eye structures as much as eight hours, and *permit* him to use them in close, taxing work for ten hours or more a day. His eyes will no more tolerate such unwarrantable abuse than will his muscles or his brain. Something must in time give way, and usually it is the retaining coat which gives form and stability to the globe. . . . We have made a fetish of books. We have become a reading rather than a thinking people."

He refers to a report on the subject by the Association of Women Principals of New York City, which noted in these columns at the time of its appearance, and suggests that to secure conclusive results the work of this committee should be carried out by oculists in conjunction with educators, publishers, and printers.

Present Methods of Printing Produce Eye-Strain.

The general character of printed matter at the present time is unquestionably a serious menace to the soundness of vision of the rising generation. Modern improvements in printing machinery and processes form an exception to the rule that modern science has improved every condition of life which it has touched. In printing the improvement has been in the way of enormously cheapening costs, but the results, at least so far as the effect upon the eyes is concerned, have been rather retrogressive than otherwise. The sense of rest and ease that one feels on

reading a book printed fifty or more years ago is a familiar experience. This was before the time of machine set type and chemically engraved plates for illustration. What little gloss the paper may have had was obliterated in the dampening which always preceded the press-work, and the type, working on this dampened paper, produced none of the hair lines which are now so often thought to be a mark of fine quality in printing.

An added element of charm, as well as of comfort, in the old book is the perceptible yellowing of the paper, which takes away the glare that results from looking at a pure white surface. The dampening of paper facilitated its taking the ink from the types, and also reduced wear, which was a very proper precaution when types were used over and over again. All books to-day are printed from new type which is thrown into the melting pot when it has served for this one printing, so that there is no necessity for this precaution.

The hand-engraved plate has also become nearly extinct, the so-called "half-tone", or chemically engraved plate having taken its place. These chemically engraved plates consist of a network of exceedingly fine lines or dots, generally 130 or 150 to the inch. In order that these microscopically fine lines or dots may be impressed upon the paper in printing it is necessary that the surface of the paper be as smooth as possible. To meet this condition the paper is coated with clay and burnished to a hard, glossy surface. Even the uncoated paper is generally calendered and burnished to the highest degree possible. It is this glossy surfaced paper to which Dr. Lewis so rightly objects as a material for books, especially for children. The use of coated or glossy paper for printed matter is an evil by no means confined to elementary text books; it is found to a large extent in all book printing.

Fortunately, there is good reason to believe that this single exception to the benefits of scientific progress is likely to disappear in the near future.

New Printing Process Will Avoid This Fault.

An entirely new method of printing, the details of which cannot be discussed here, has already reached the commercial stage, and promises to revolutionize the art as completely as did machine type-setting and chemical engraving. This new method is known as the "off-set process", the actual printing surface which comes in contact with the paper being sheet rubber instead of metal types. The feature of this method which concerns the present discussion is the ability to print the finest of chemically engraved plates upon matt surface paper. This method has already reached such a state of perfection as to make it entirely practicable for use in book printing. The ban against coated paper for text books may therefore be urged without encountering the obstacle of mechanical objections.

The use of lightly tinted paper is likewise a reform which can be secured without the slightest loss or trouble on the part of printers. The use of type faces having no hair lines is an equally simple matter, as such faces are not only produced by the type founders, but are steadily gaining in popularity. The best faces are the Caslon and Scotch Roman. This page is an example of the former.

There is thus no sufficient reason, economical or otherwise, at the present time why all text books should not be printed upon matt surface, cream tinted paper with a type face having no hair lines. Such a requirement would in nowise restrict the use of all present methods of illustration.

Dr. Lewis is quite right in saying that we have made a fetish of books, and that we have become a reading instead of a thinking people. Reading, to a large extent, has become a kind of literary debauchery instead of a mental and moral stimulus. But this is rather a subject for the sociologist and the educator; it is the incidental evil of eye strain with which we are directly concerned. Text books and other books are by no means the only offenders by way of print. The penny newspaper has necessitated the reduction of mechanical cost to the minimum, with the result that much of the news matter is printed in a type so fine as to strain the eyes, even with the best of illumination. When it is considered how much of this

is read on railway trains and street cars under the worst possible conditions of light, it will be seen that the problem of the conservation of vision by no means stops with the schools.

School House Lighting a Menace to Eyesight.

The September issue of "Good Housekeeping" contains a symposium of articles on schools and school houses, among which is a contribution from Mr. Wm. L. Nida, Superintendent of Schools at Forest River, Ill., on the lighting of schoolrooms. While Prof. Nida deals almost entirely with daylight illumination, the importance of conserving the vision of school pupils is brought out with impressive emphasis. The opening sentence of his article furnishes food for the most serious reflection on the part of school authorities and the public:

> "In a recent physical examination of the school children of Forest River, Ill., it was found that 55 per cent. of those in need of medical attention were suffering from defective vision."

The article then points out the great inequality and other defects of the ordinary daylight illumination of schoolrooms by windows along one side of the room, and proposes as a remedy the one-story school house, lighted either with the flat skylight or with the saw-tooth construction now commonly used in the erection of industrial works. The single reference to artificial lighting is a brief description of indirect illumination, which he favors as simulating skylight.

It is highly important that we do not jump at conclusions as to the value of shadowless, overhead lighting upon any theoretical grounds; but passing over this point for the present, the subject of schoolroom lighting, both natural and artificial, is one which cannot be overlooked by any one in any way responsible for school buildings without making himself guilty of criminal negligence.

In the great problem of the conservation of vision, the division which deals with public education should give careful heed to the following points:

1. Proper daylight illumination.
2. The best methods of artificial illumination.
3. The abolition of glossy white paper and small or hair line type.
4. The prohibition of protracted or excessive use of the eyes in reading, writing or other similar close work, especially by the younger pupils.

Public Libraries Need Better Lighting.

The public library and free reading room have become established and important adjuncts to the educational facilities afforded by the schools. All that has been said concerning the conservation of vision of school pupils applies with equal force to the patrons of libraries. There are certain special conditions in the latter case which demand attention. The library and reading room is used far more by night than by day, and hence the importance of securing the proper artificial lighting.

There are some remarkable idiosyncrasies in the library situation in this country. While millions of dollars have been freely given for the erection of magnificent buildings, there is very generally a degree of economy amounting often to the meanest type of parsimony in carrying out the purposes for which the building was erected. The compensation of attendants is nothing less than an outrage. These are generally young ladies who must not only have a degree of intelligence above the average but must undergo a special training for the work aside from a good basis of general education, and whose lives must be absolutely above reproach. In return for this unusual list of accomplishments they receive, even in the expensive city of New York, around $35 a month! With such an example of niggardly economy before us we need not be surprised to find the most unscientific and dangerous systems of artificial lighting in use. If there is a philanthropist in this country who can be satisfied with knowing in his own conscience that he has materially aided hundreds of thousands of those who are most deserving of help and attention, let him devote his wealth to the work of reforming the facilities afforded in our public libraries and reading rooms; and, first of all, let him give his attention to the lighting.

Need of Instruction on the Use of Light in the Home.

But if every school room, library and reading room were lighted in accordance with the most approved principles of illuminating engineering, the problem of the conservation of vision of the rising generation would by no means be solved. In fact, the most difficult phase of the subject would still remain—viz., the proper use of light in the home. There is no form of abuse of the eyes that does not flourish unchecked in the homes of the rich and poor alike. Sitting with the eyes facing a window and the book or paper in the shadow; the same position taken with artificial lights; reading far into the twilight; the use of unshaded, dazzling light-sources; unremitting use of the eyes to all hours of the night—these, and the rest of the catalogue of eye-abuses, are all common practices.

The only way of reaching these is by public education. Such public education should begin in the schools and be extended through every available channel. Systematic instruction on the fundamentals of illuminating engineering, consisting of an elementary study of the structure and functions of the eye and directions for its proper use should be given in every grade; and where defective vision or eye strain is detected in a pupil the parents' attention should be specifically directed to the necessity for the proper care of the eyes at home. The instructions on this subject ought to be given in the textbook on physiology and hygiene and particularly called to the parents' attention; or, better still, a separate pamphlet on the subject put in their hands.

The effect of eye strain upon the nervous system, and consequently upon the health, both physical and moral, of the pupils, is second to no single problem in public education to-day. It is a subject upon which there is almost no authentic and definite knowledge, and one, therefore, which calls for careful and extensive research. Such investigations as have been made indicate that the disposition and conduct of pupils, as well as their physical health, is directly and seriously affected by eye strain. Let us have more knowledge upon this subject.

The necessity for precautions for conserving the vision of the working population of this country are noted elsewhere in this issue. When we have carried the theory into practice through all our channels of public education and have reinforced this with wise and proper measures for governmental inspection and regulation in the places where human labor is carried on, we shall have taken a step in the conservation of our human resources that is beyond calculation.

Railway Illuminating Engineering

Our comments on this subject brought forth the following reply from the *Railway Electrical Engineer:*

"We do not believe the situation is quite as bad as our friend *The Illuminating Engineer* seems to think. There is undoubtedly room for great improvement in railway lighting, but rapid strides in that direction are being made. Cars are being equipped for electric lighting as rapidly as possible. Nearly all the new equipments are designed carefully to fit the peculiar requirements of this form of illumination. The carbon filament is being replaced with tungsten. The bare lamp is giving away to the judicious use of shades. Car lighting is coming to be recognized as an art.

"Railway illuminating problems are problems for the electrical engineer. The superiority of electricity over gas and oil for train lighting is so evident that train lighting is necessarily an electrical problem. There is room for gas in station lighting perhaps, but even there the flaming arc is rapidly coming to dominate the situation. It is a mistake to say that the railroads are without illuminating engineers, for many of the electrical engineers are illuminating engineers—and good ones."

It is a pleasure to hear from such an undoubted source of reliable information as our contemporary that rapid strides are being made in the improvement of railway lighting, but we cannot quite agree on all the points made in substantiation of this fact. Our contemporary is professedly devoted to electric lighting; to say that cars are being equipped with electric light is not sufficient guarantee to the illuminating engineer that the illumination is necessarily thereby improved. So far as illumination is concerned, as measured by its effects upon the eyes, the mere substitution of electric lamps is not by any means a cure-all for the evils that have existed. The statement that the bare

lamp is giving way to the judicious use of shades is of far more importance to the public than that electricity is replacing gas. Aside from considerations of safety electricity has no monopoly on good illumination in railway cars. The electric berth lights are undoubtedly a convenience as long as there is but one used; but when both lamps are lighted, as often occurs when the occupants of the upper and lower berths are occupying facing seats, it is impossible for either occupant to escape the glare of the light opposite; and even this convenience can now be obtained from gas.

To claim the entire field of railway illuminating engineering for electricity is to take a very superficial view of the case. In fact there is no other general class of lighting that uses every available illuminant to so great an extent. Kerosene oil, gasolene, acetylene, illuminating gas and electricity are all important factors in the general problem.

The concluding statement of our contemporary contains the whole point at issue. From the very first inception of the movement to establish illuminating engineering, the electrical engineer has claimed jurisdiction over the whole lighting case. The electrical engineering profession in this respect assumed a position very similar to that of the potentate who ordered the invaluable library at Alexandria to be burned, on the ground that if it contained anything not found in Holy Writ it was heretical and deserved to be destroyed, and if it contained only what was found there it was useless and might as well be burned. This was the attitude of the American Institute of Electrical Engineers when the formation of an Illuminating Engineering Society was proposed, some saying that it should be a branch or department of that organization, others that they could see no more necessity for the formation of such a society than for an "association of armature winders."

Our contemporary ingenuously infers that any light that is not electric is not worth considering, and that electric lights can be handled perfectly well by electrical engineers. It is the first part of this assumption that is so widely erroneous. The very fact that railways are obliged to use all the different illuminants, on account of conditions beyond their control, is in itself the strongest reason for the employment of an illuminating engineer, who looks at every problem with an absolutely unprejudiced view and seeks only to secure the best possible results under the particular conditions involved in each problem. These conditions may involve the choice of an illuminant, or they may fix the necessity of use upon some particular light unit. So long as the question of lighting is considered a side issue of the electrical or any other department of a railway it is useless to expect results comparable to those obtained in the other departments of the service that are in the hands of specialists.

Electrical engineering is a good technical basis upon which to build illuminating engineering, but it is only a foundation, and, especially in the case of railways, should never be considered as the entire structure. The problems in railway lighting are so numerous and involve so many peculiar and special conditions that nothing short of undivided attention and wide experience can produce a thoroughly competent railway illuminating engineer. The sooner the railways begin to look about for the most promising candidate and send him to work specializing on this highly important phase of railway practice the sooner will the innumerable faulty, wasteful, and even dangerous, lighting installations be eliminated.

The High Efficiency Lamp and the Central Station

The sudden and simultaneous appearance of new electric lamps of both the incandescent and arc types requiring a third or less of the current of the types formerly used was an event particularly well described by the old metaphor, "a flash of lightning from a clear sky." If you were producing an indispensable commodity and were selling a certain quantity at a price which was insuring you a reasonable return on your investment and if a sudden means were discovered whereby only one-third as much of your product were required, what would you do about it? In considering the answer to this

question one fact might as well be reckoned with as sure and final—viz., that the improvement cannot be downed and that the people are going to make use of it sooner or late—and in this age of general intelligence it is safe to assume that it will be sooner. History has shown that such innovations which have been numerous in the progress of labor-saving machinery and discoveries have necessitated a certain amount of economic readjustment, and occasionally some temporary inconvenience and loss; but they have invariably in the end worked to the good of all parties.

The advent of the high efficiency lamp then resolves itself into a question of how to make the transition from the old to the new conditions with the least interruption of the established order of things, and consequently the minimum of loss and inconvenience. That this broad view of the situation has been generally taken by the central station is evidenced by the ready acceptance of the new forms of electric lamps.

To get down to more specific considerations, what is to be the future position of the flaming arc lamp in public lighting? The unusual volume of light, together with the rather distinctive color of this new light-source, brought it at once into favor as an advertising attraction, and insured for it a very considerable private use in exterior lighting for this purpose. But where the flaming arc has been used in front of business blocks it has so completely eclipsed the carbon arcs regularly used for street lighting as to make them appear what they were derisively described in the Colorado Springs Controversy—a "crippled lightning bug in a bottle." In fact, no light-source could stand beside this new leviathan in illumination without being hopelessly dwarfed. Thus far the flaming arc has made astonishingly little progress in public lighting in view of its remarkable light-producing power. It would naturally be supposed that those seeking to "make the streets as light as day"—as the newspaper reporters have it—would gladly avail themselves of a light-source of such astonishing power and efficiency as the flaming arc; but up to the present writing the public installations could be counted on the fingers of one hand, while installations of tungsten clusters can be numbered by the score. There are a number of explanations for the failure of the flaming arc to secure a prominent position in decorative or commercial street lighting. It is possible that the lamp suffers from an embarrassment of riches in the quantity of light produced. The distribution of its rays is such that, in order to produce approximately uniform illumination, the lamps must be placed fairly close together, or else very high; and in any case the general intensity of illumination is so far in excess of anything ever attempted before that it makes even ordinarily good lighting appear insignificant. It is certainly a producer of odious comparisons, innocent though it may be of intention in this regard.

Another very possible element in retarding its use is the color of the light ordinarily produced. This is so distinctly ruddy as to border very nearly, if it does not actually overstep, the bounds of the lurid. The bystanders' comment on seeing the first lamps put up on Broadway was an exceptionally happy description of the effect—"it looks like a bonfire." Not only has it this objection of suggesting a conflagration when seen at a distance, but it gives an unnatural, doughy pallor to the faces of those seen by its light. This distortion of the complexion is very apparent.

A considerable part of the efficiency of this lamp is due to the fact that it produces a large quantity of yellow rays, the color which is most effective in producing vision. The production of white light must always be at the expense of physical efficiency, for light is measured physiologically, and not mechanically, and we cannot change the constitution of the organs of vision. The flaming arc, however, is so much more efficient than the carbon arc that it may well be questioned whether it would not be worth while to exchange some of this physical efficiency for a more pleasing color of illumination. The tungsten and Nernst lamps and the Welsbach gas burner are all very similar in the color of the light produced, and can scarcely be distinguished in general illumination. It would be very desirable to produce substantially this quality of light for general exterior lighting. A white flaming arc is, of course, as easy to obtain as the yellow, the difference being in the chemical im-

pregnation of the carbons. Judging by the results produced in this city by the white flaming arcs that have been installed for demonstration purposes, the quality of the light so produced leaves nothing to be desired in respect to color.

The short life of the carbons is an unquestioned handicap, although in this respect it merely puts the flaming arc back to the position of the old open arc. The more frequent trimming is simply so much added to the maintenance cost, which must be charged up in the final reckoning of efficiency.

The enormous increase in efficiency of the flaming arc over the ordinary enclosed carbon arc—the difference being five or six to one in favor of the former—could not be expected to predispose the central station to its use, but nevertheless the flaming arc is here to stay, and must eventually take a position based absolutely upon its relative merit. But aside from its general principle the higher standard of illumination which the use of the flaming arc must inevitably set cannot help but have a stimulating effect upon public lighting in general and even upon private lighting. The results of this general raising of the standard of illumination would undoubtedly much more than offset the decrease in revenue represented by its greater efficiency. It is hard to conceive of anything that would set a swifter pace for the use of electric light to such an extent as a complete covering of the business section of a city with this high-power unit. Unquestionably the wiser view for the central station is the far-sighted one, the one that looks beyond the income of the present month and sees the possibilities and the inevitable trend of improvements in the future.

As to the lamp itself there are three points in which a change in its present condition would be advantageous—viz., longer life of carbons, an approximately white light—at least as white as the tungsten lamp and a much wider curve of distribution of the rays. At least two of these improvements have been the subject of apparently successful study by Professor Blondel, and the results of his work are well worth careful investigation. With these improvements accomplished to a reasonable extent the flaming arc should take a prominent place among high-power units for the illumination of business centers, public squares and large open spaces.

Specifications for Street Lighting

The ancient fiction of the 2000 candlepower electric arc persisted in municipal contracts until scientific progress has furnished the means of making the fiction a reality. The longest step taken out of the absolute darkness of ignorance in regard to the real illuminating power of arc lamps was the report of the committee on street lighting specifications presented at the N. E. L. A. Convention at Washington three years ago. That the methods of determining the value of electric lamps laid down in this report were not perfect may be readily conceded. It would have been nothing less than miraculous had this first step actually led to perfection. As an exposition of the necessity for some more logical method of specifying street illuminants it was of sufficient value to more than justify all the work done by the committee.

Among the first fruits of this report are the specifications recently drawn by the city of Montreal in its call for tenders for the lighting of its streets. The word "standard" as used in these specifications of course is simply for the purpose of this one particular contract, and manifestly can have no general application; but as Montreal is a city of first-class rank, what its electricians and public officials consider standard is of no small interest to the lighting fraternity.

According to these specifications a standard arc lamp is "A direct current series luminous arc lamp (magnetite) with an internal concentric reflector, with clear globe, consuming not less than 6.6 amp. at a voltage of from 75 to 80 at the lamp terminals, and equipped with electrodes of the best quality obtainable." Standard incandescent lamps are "40 c.p. and 80 c.p. (mean spherical) tungsten lamps (series)."

The specifications for defining the standard illuminating power and the method of its determination are those recommended by the committee report above referred to, viz., the measurement by use of a calibrated 16 c.p. lamp as a standard of the rays reaching the pavement between 200

and 300 ft. from the lamp, and on a plane 5 ft. above the surface. It is particularly noteworthy that all measurements to determine whether the terms of the contract are being fulfilled in point of illumination furnished are to be made of the lamps actually in service, in other words, by illuminometer measurements made upon the streets.

Other noteworthy features of these specifications are the rating of the series tungsten lamps by mean spherical candle-power, the requirement that "no incandescent lamp shall be continued in service after its candle-power has declined below 90 per cent. of the initial candle-power," and that "the mean normal unobstructed illumination at any point nearer the lamp than the test point shall not be less than that determined at such point". This last provision is a safeguard against the use of any form of freak reflector which should condense the greatest intensity of rays at the test points. There are also careful provisions for such measurements and tests as will keep a continuous check upon the illumination furnished.

The one loop-hole in these specifications is the neglect to mention the intensity of illumination in the given position, *i.e.*, at a height of 5 ft. at a distance of 200 to 300 ft. from the light-source. The definition of standard illumination by arc lamps, as previously quoted, simply takes the magnetite arc as the primary standard. As the arc lamp of any form is about the last thing that any photometrician would recommend as a primary standard, the looseness of this provision in what are otherwise careful specifications becomes apparent. Should friction arise in the fulfillment of this contract this particular loop-hole would seem to afford almost as good an opportunity for controversy as did the old 2000 candle-power fiction.

It is generally admitted that a contract is the most fertile source of litigation in the whole domain of law, and hence the necessity for the utmost care to avoid ambiguities, and what may afterward appear as "honest differences of opinion."

Making the "White Way" Whiter

In our issue of a year ago we referred to the desirability of white buildings in making a city bright and attractive, taking the World's Fair of 1893 as an object lesson. The remarkable development of architectural terra cotta in this country has introduced a powerful factor in giving cities the dress of sanitary cleanliness, as well as cheerful beauty. The revival of classic architecture has brought with it a return to the use of white marble in construction, and this in turn has suggested the use of white terra cotta.

Aside from the sentimental effect attaching to its inherent value, the white marble must take second place to the white terra cotta; for marble not only colors with age but becomes stained and grimy in cities where there is a prevalence of bituminous coal smoke, while the glazed surface of the terra cotta is not only absolutely permanent in its color but requires nothing more than the elements to keep it in a reasonable state of cleanliness and purity. It is a pleasure to note the increasing use of this material, especially in New York.

The effect of a general use of white or light material in building upon the appearance of a street, both by day and by night, would be very marked, and a decided improvement over the red brick and brown stone that held sway in the dark ages of American architecture about 30 years ago.

It may be going a step too far for the illuminating engineer to even suggest to the architect the material that he should use on the exteriors of buildings, but there is no harm in calling general public attention to the decided advantages of light colors or white for modern business blocks.

The "White Way" has now become an established institution in American municipalities; it indicates simply an exceptionally well-lighted business thoroughfare the whiteness of modern illuminants as compared with the old-time gas jets giving it its title. Why should we not have the "White Way" white by day as well as by night? Let illuminating engineers and the lighting interests promote this idea with all reasonable enthusiasm within range of their prerogatives. No single step could be taken that would bring us nearer to the realization of the "City Beautiful."

The Fourth Annual Convention of the Illuminating Engineering Society

The fourth annual convention of the Illuminating Engineering Society will be held October 24 and 25, 1910, at the Johns Hopkins University, Baltimore, Md.

As previously announced in these columns, following the two days' convention there will be given at the university a course of thirty-six lectures on illuminating engineering. These lectures will be given in the physical laboratory from October 26 to November 8. The lecturers have been invited by the university upon the advice of the society, and will be representative of the best and most advanced thought of the profession.

Notes and Comments

The New Public Lighting An Incentive to Other Reforms

Reform is contagious — the primary movement for betterment always carries with it a trail of smaller improvements, and it not infrequently happens that, in the end, the sum total of the smaller improvements overtops the original reform.

The new public lighting is one of the most conspicuous reforms in municipal affairs that has ever taken root on American soil. Doubtless it is this fact of its conspicuousness, of its aggressively self-evident value, that has given this reform such an unprecedented impetus in so short a space of time. There are few reforms that have brought about such immediate and tangible results. The citizen who to-night steps into a brilliantly lighted thoroughfare that last night was a dismal and gloomy street needs no hair-splitting logic nor appeal to his conscience to convince him of its value. The results are there, before his eyes, and appeal to his personal gratification, his civic pride, and his business instincts alike.

A review of the various reports of progress of the new street lighting movement gleaned from the daily press brings out a number of interesting points showing that this reform is already exerting a wholesome influence for civic improvement.

As an example of the far-reaching effects of a comparatively small original installation of decorative lighting Philadelphia unquestionably takes the lead. Public interest in the subject has never flagged from the time the memorial lamp standards around its City Hall were first put into service. The general spread of the demand for the new lighting has been recorded in these pages from month to month. On the evening of September 15th the consummation of the general plan for lighting the business center of the city, which was the immediate outcome of the City Hall installation, was officially announced by Mayor Reyburn, when he switched on nearly a thousand new lamps. Some of the interesting details of the new lighting are thus given in the *Record*:

"The first step in this new plan was put into effect when the new lights on Market street, east of the City Hall, were turned on for the first time last New Year's night. The demonstration last night was the second step in the realization of the scheme. It covers the business streets from Walnut street to Arch, and from the Delaware to the Schuylkill. 'These streets are now lighted better than those of any other city in the world,' said Chief McLaughlin last night.

"A detail of no small importance in the plan of the illumination is the ornamental pole carrying the lights. There are 456 of these specially designed metal poles, similar to those in use on Market street, on each of which hangs two of the new lamps. Each of these poles is 22 feet high, and the lamps hang 18 feet above the pavement. This height has been found to give the best results for the purpose of illumination after extensive tests and demonstrations by the Electrical Bureau."

That the lights should at first attract crowds into the streets is inevitable. That the nightly street traffic will be permanently increased is confidently expected by the merchants, as is shown by the following paragraph in the *Star:*

"Merchants in the central section of the city are planning special displays as an adjunct to the new system of lighting which now makes the streets almost as light as day. Quite a number of the merchants have decided to keep their stores open on one or two nights a week."

This would seem to be the first serious start toward a reform that we suggested a year ago, namely, of keeping the larger stores open evenings. The practice of pulling down the shutters at the setting of the sun is a relic of the days of the night watchman with his tin lantern. There is no sufficient reason, either on humanitarian or business grounds, why the stores in the central shopping districts should not be kept open until a reasonable hour in the evening, at least a part of the time. The new street lighting may bring about this reform among others. While it undoubtedly is an advantage for the merchants to attract people on to the streets in the evening simply to show their window displays, such an advantage is a mere trifle compared with what they would receive by throwing open their doors, and thus not only affording the citizens an opportunity of combining business with pleasure, but of permitting those who are necessarily engaged during the day to do their shopping in their leisure hours.

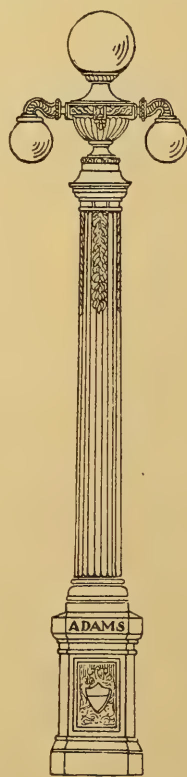
The case of Philadelphia is also notable in that its new lighting system is being put in and operated independently of private contributions. Public lighting is either a public utility or a public luxury, and the expense should be borne by the public at large. In this case the local central station has wisely borne a fair share of the initial expense. The untiring and unusually competent work of the city electrician in this movement is also worthy of the highest praise. These facts are thus brought out by the *Star:*

"Installed at a cost of nearly a quarter of a million dollars by the Philadelphia Electric Company, without a cent of outlay on the part of the city, Chief McLaughlin, of the Electrical Bureau, again achieved the seemingly unattainable by giving the city a great public improvement without imposing any further drain on the city's financial resources beyond what it will cost in the way of maintenance."

Because Philadelphia merchants have not contributed to the lighting, however, is no evidence of their parsimony or lack of appreciation of public improvement. It is now proposed to add a feature that is unique in this country by way of embellishment to the lighting system; this consisting of ornamental brackets attached to the lamp posts, each bearing a basket of flowers in season. We quote from the *North American:*

"To still further enhance their beauty, it is planned to place wrought-iron wicker baskets from short side arms at a distance of about ten feet from the sidewalk level. Designs for these baskets are now being drawn. Strawbridge & Clothier have offered to pay the cost of the baskets to be placed on Market street, as well as to pay the cost of having them kept filled with seasonable plants and flowers."

Philadelphia's electric lighting budget will now run close to a million and a half dollars a year. So far as public opinion is expressed by the daily press, however, not the slightest objection has been raised.



TYPE OF NEW ORNAMENTAL STANDARD FOR INDEPENDENCE SQUARE.

On this point an editorial in the *Bulletin* may be taken as representing public sentiment on this point:

"For all of this the citizens must foot the bills. Wood block paving and arc lamps cost money. But it is the history of all great cities that money thus spent is money well invested. Part of the return comes in the form of advertising disseminated by the traveling public. The man from the South who comes in search of merchandise for his stores; the man from the West who is on pleasure bent; the New Englander who seeks historic spots—all of these cannot go away without noting the excellence or lack of excellence in paving and lighting.

"Greater than this, however, is the value of an up-to-date street equipment to the people themselves. What outsiders think of Philadelphia may be important. What the city affords in comfort, convenience and security to its residents is of paramount moment."

The crowning glory of this new lighting will be the installation around the historic Independence Hall. Probably no installation of decorative lamp posts in this country has received more thoughtful attention than those to be erected on this cherished spot. The outline of the design is shown in the illustration. This design has been accepted by the city and is the result of the work of the Philadelphia division of the American Chapter of Architects. There will be 56 of these posts, one for each of the signers of the Declaration of Independence, and each will bear the city arms and the name of the signer to whom it is dedicated.

CINCINNATI FALLS IN LINE

Cincinnati is the last of the larger Western cities to fall in line for the new street lighting. But it has taken a definite move at last, according to the *Times-Star:*

"Cincinnati is to have a 'Great White Way.' Vine street, between Sixth and Eighth, is to be as light by night as by day, if artificial means can make it so. Merchants and business men in the two blocks have united in a private plan for illumination that will be put in effect immediately. Twenty clusters of five brilliant electric lights are to be erected at as many points in the two blocks. It is thought the scheme will be quickly adopted by others and extended not only on Vine street, but in other sections of the downtown district."

A TEXAS CASE.

One of the most remarkable features of the new lighting reform is the extent to which it has reached the smaller towns. Sherman is a city in Texas credited with 11,989 population. The following special from this town to the *Dallas News* tells its own story:

"The new street lights of North Travis street have been put in operation. These lights are on iron posts and set every fifty feet, alternately, on either side of the street. The street is as light as day, presenting a beautiful appearance. Both Saturday, the opening night, and Sunday night this thoroughfare was crowded to the limit, the appearance of the street and the great throng of people making one think of circus day or some similar event."

The picturesque little town of Nyack, on the Hudson, is to have a carnival, which will realize our suggestion of the annual "Carnival of Light," according to an item in *City and County:*

"The lights will be arranged on a grand scale. There will be 400 sockets mounted on streamers 18 in. apart with 16-candle-power lamps to the number of 1008; 20 switches and cutouts with fuses; 2000 ft. of wire with lights, and a 16 x 4 ft. sunburst with 120 8-candle-power lights of white and red bulbs, 50 in number."

Bellefontaine, Ohio, has been inoculated with the germs of this reform, according to the *Index-Republican:*

"Some one has suggested to city officials the abolishing of the arc lamps on the street corners in the business district of Bellefontaine to be replaced by clusters of electric lamps, atop perpendicular posts, on each of the 4 corners of each street intersection. This style of street lighting originated in Los Angeles, Cal., and has since been adopted in many cities all over the United States."

Philadelphia is by no means the only example of the spread of the good-for-better lighting when once an example, as the following reports of the extension of the movement in other cities will show:

"Hennepin avenue, from Fifth street to Washington avenue, was last night added to the 'White Way' of Minneapolis. This was the last addition to the new system that brightens Nicollet and Hennepin through the business districts."—Minneapolis *Tribune.*

"Believing that Cherry street, if properly improved and lighted, will draw a larger share of the trade coming to the retail merchants of the city, about 50 business men of the district met Tuesday night and organized the Cherry Street Business Men's club. A resolution adopted sets forth the objects of the club to secure needed street

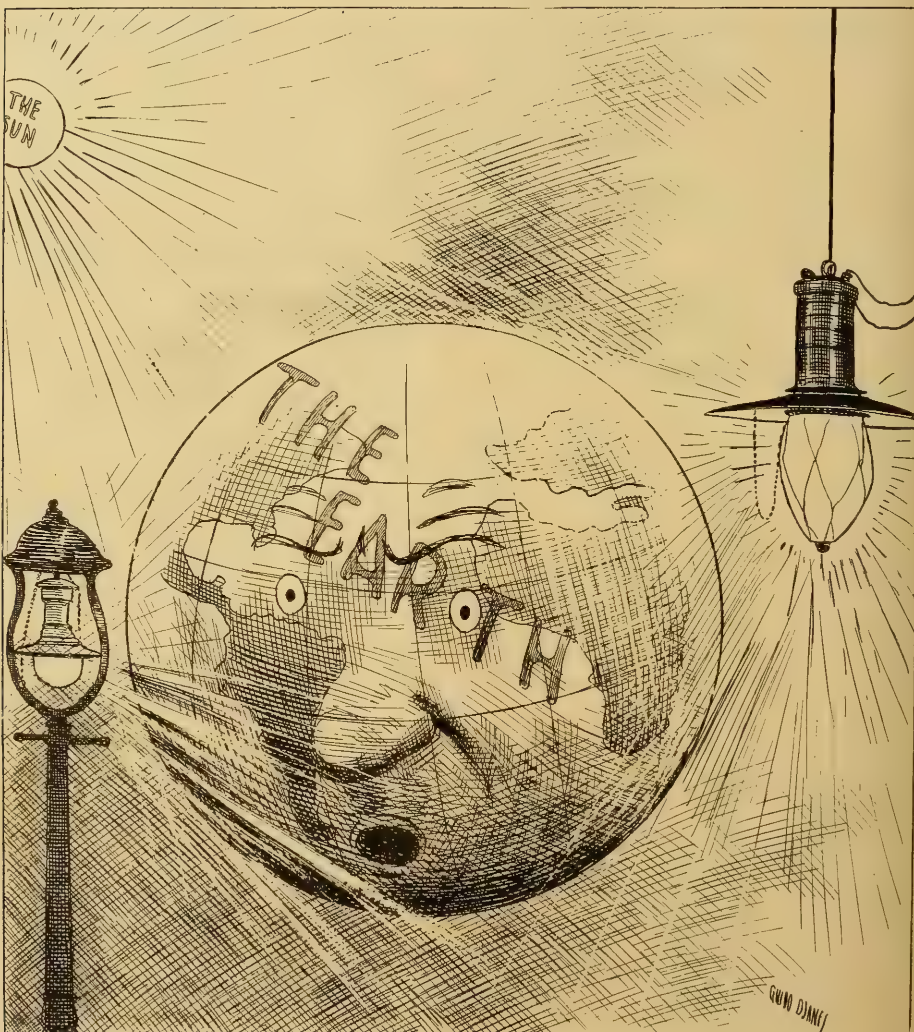
improvement, such as repaving, additional lighting, the inauguration of a system of advertising, and co-operation among the business men of the district."—*Toledo Blade.*

"Better illumination of business streets and methods of installing and maintaining it were talked over yesterday by the municipal affairs committee of the Commercial club and F. A. Nash, president of the electric light company.

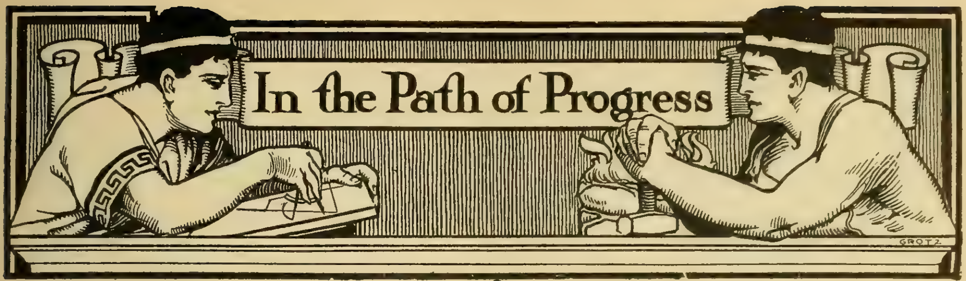
"Mr. Nash was there by invitation and considerable time was devoted to discussing of a better system of lighting than now exists.

"The question is to get installed improved lighting, taking for a start perhaps Tenth street from the passenger stations up to Farnam street; from Tenth to Sixteenth, and Sixteenth from Capitol or Dodge to Howard or Jackson. Who will install the lights and who will maintain them is to be threshed out in view of the inability of the city under the present charter to create lighting districts. Minneapolis, St. Paul and other cities having lighting districts will be asked for data and another meeting held in a few days when the information wanted is at hand.

"A system of curbstone lighting similar to that of the '500' block in this city, but with more elaborate light standards, is in view."—Omaha *World-Herald.*



THE EARTH: "BETWEEN THESE TWO, WHEN DO I SLEEP!"



The Cooper Hewitt Lamp For Alternating Current

One of the peculiar features of the mercury arc which was discovered in the course of development of the Cooper Hewitt lamp has furnished an exceedingly valuable means of transforming alternating into direct current. This device, known as the mercury arc rectifier, has come into quite large use in connection with the magnetite arc, and has heretofore been used with the Cooper Hewitt lamp when alternating current has been the only kind available. Successful as this arrangement was, it was not to be expected that an investigator of Mr. Hewitt's type should be satisfied to "let well enough alone." A lamp that would be self-contained and require only to be connected to the source of supply when run on alternating current is manifestly an improvement over any lamp requiring auxiliary apparatus. This has been successfully accomplished by the Cooper Hewitt Electric Co., and is embodied in their new alternating current lamp, which they designate as Type F. From a recent bulletin issued by the Company the following information is gathered:

The lamp contains the same arrangement of mercury tube as the D. C. lamp. The special electrical devices necessary, which constitute what is termed the auxiliary, are compact in form and inclosed with a metal cover, to which the tube and reflector are attached.

NEW TYPE F.—COOPER HEWITT LAMP.

The auxiliary also contains the mechanism for self-starting. The lamp is regularly made for a frequency of 60 cycles. The auxiliary of each lamp must be properly adapted to the average line voltage. Two different lengths of tube are used, of 50 and 55½ in. respectively, the former consuming 350 watts and the latter 430 watts, with a power factor of 50 per cent.; watts per candle, 0.52 and 0.51.

This lamp is for indoor use and is specially adapted to the normal conditions existing in industrial plants. The successful production of an alternating current lamp must inevitably greatly increase the use of this form of illumination, especially for industrial purposes.

The Opalux Company

The above is the corporate title of a company recently organized to handle the line of reflectors which were put upon the market some two years ago under the trade name of "Opalux."

It is doubtful if any new type of illuminating glassware ever met with such immediate recognition as this line. Owing to certain business changes among those who were primarily interested in this glass its commercial advancement was unavoidably at a standstill for some months. The organization of The Opalux Company, whose executive offices are at 258 Broadway, New York, removes this handicap and will again place the glass in the hands of the public. If their success is measured by the reception which the glass first received the company will soon become one of the leading factories in the illuminating glassware business.

The Buckeye Electric Company of Cleveland has recently opened a branch office in Pittsburgh in the Fulton Building. This office will be in charge of their Mr. Foster, who formerly covered the Indiana territory.

Proceedings of Technical Societies

Illumination

By A. S. Hubbard.

Read before the National Association of Cotton Manufacturers, Portsmouth, N. H., September 22.

The writer first makes a telling argument in favor of adequate illumination of textile mills by showing how trifling the cost of light is compared to the cost of labor. His figures are well worth remembering:

"Compared with the cost of labor and the value of the product turned out, the cost of producing artificial light is so insignificant a factor as to make its serious consideration ridiculous. A simple reckoning will make this point clear.

"One cent will, therefore, pay for the illumination produced by one of these sources for an entire day of ten hours. In other words, if every operative were given two carbon filament lamps or one tungsten lamp for his own exclusive use, or one arc lamp was provided for each five operatives, or one Cooper Hewitt lamp for each four operatives, the cost of current for the entire day would only be 1 cent for each operative. Suppose the average wages of the operatives to be $2 per day for ten hours, to make reckoning easy. This is 20 cents per hour, or 1 cent for three minutes; therefore, an operative would have to lose but three minutes' time to represent a money loss equal to the cost of more light than he would need for an entire day. How much of an imperfection or curtailing of product would it take to represent 1 cent? Surely this is a convincing case of the *reductio ad absurdum* method of argument."

The paper then goes on to give an analysis of the requirements of good illumination in general and the special conditions which maintain in the textile industry. He dwells particularly upon the importance of quality in light, under which term he describes the difference in radiation of light-sources emanating from incandescent solids and those produced from incandescent vapor of mercury. On this latter point he makes the following statements:

"The mercury vapor lamp differs from all other sources in giving no red rays whatever. Consequently, the light is of a bluish-green color. Being the most highly efficient of all electric light sources, follows that it contains a less proportion of heat or luminous rays. The most remarkable feature, however, of light of this quality is the greatly increased acuity of vision which it affords; that is, the eye can distinguish, or "resolve," as the oculist would say, fine objects or details with greater ease and distinctness by the light of the mercury vapor lamp than by any other luminant in commercial use at the present time.

"Another peculiarity of light of this quality is its ability to render objects clearly visible at lower intensities of illumination than is possible with white, or ordinary quality of light. This fact has been known for some time, but has come into practical importance only with the commercial use of the Cooper Hewitt lamp. The result of this peculiarity is that the shadows are much less black or dense in the case of such light than by that of any other light source, the density of a shadow being determined by the extent to which it obscures vision. While illumination by Cooper Hewitt lamps is not shadowless in a literal sense—a condition which, be it remarked is highly undesirable—the shadows are never troublesome for the reason already given. Again, objects can be distinguished at a greater distance by bluish-green light than by light containing red rays. Lastly, the eye works, other conditions being equal, with less effort, and consequently with less fatigue, by a light of this quality than by light containing all the rays, for the reason that the red rays are the least effective in producing vision in proportion to the amount of energy they contain."

On the much discussed question of general vs. special illumination the author says:

"The question as to the relative advantages of general and special illumination has

been much discussed by illuminating engineers; but it is of entirely subsidiary importance to the question of quality of light as affecting the visual organs. With a light source that is one of dazzling brilliancy, it is of course essential that it be kept out of the line of vision, and this is best accomplished by covering it with some sort of reflector placed so as to direct its light over the special field of vision. Such directed light is evidently not as agreeable to the eyes as a generally diffused light of the character of daylight; so that a general illumination produced without glare must be accepted as the preferable method."

He concludes as follows:

"In conclusion: By far the larger part of the cost of any finished article is labor cost. To increase the efficiency of the laborer, or the human machine, is therefore first in importance in considering methods of reducing manufacturing costs. Two things contribute to this efficiency, machinery and facilities; and the skill and will of the operator. It is useless to expect a laborer to turn out his best work with poor tools. It is the part of economy to supply the best tools with the best facilities for using them, and among such facilities light stands first."

Annual Convention of the Association of Railway Electrical Engineers, Held in Chicago, September 27-30th

Two papers pertaining to illuminating engineering were presented before this convention: one on "The Illuminometer In Railway Practice," by J. G. Henninger, and the other on "Illumination," by J. R. Cravath. Reports of these have not yet been received.

Besides these papers there were three committee reports of interest, as follows:

Committee on "Train Lighting Practice."

Committee on "Illumination."

Committee on "Specifications."

The first of these reports deals entirely with the problem of generation and distribution of current.

The report of the committee on "Illumination" is entirely taken up with the subject of various forms of incandescent lamps used for train lighting. This data refers to comparative life, efficiency, etc., which have been given in our pages before.

The committee on "Specifications" presented a very complete set of specifications for the various types of lamps suitable for train service.

The Fall Convention of the New England Section of the National Electric Light Association

This convention was held at New London, Conn., September 13 and 14. Papers of interest to illuminating engineers were read as follows:

"Illuminated Advertising," by Mr. L. D. Gibbs, Superintendent of Advertising, Edison Electric Illuminating Co., Boston.

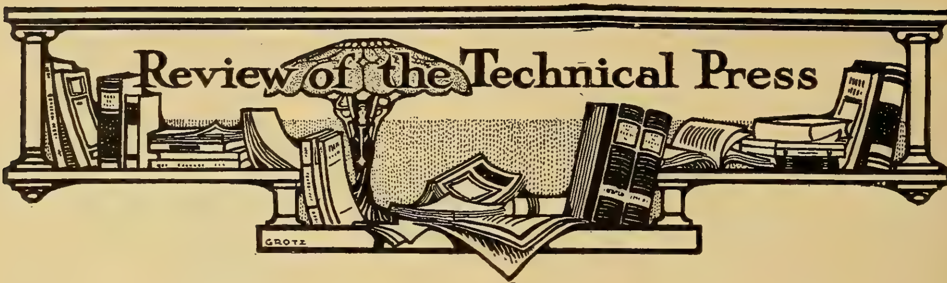
Mr. Gibbs set forth the advantages of popular lectures illustrated with stereopticion views as a means of familiarizing the public with the various uses of electricity. He exhibited some fifty lantern views himself, as an object lesson of what might be done in this direction.

A paper on "Special Decorative Street Lighting," was presented by Mr. J. A. Hunnewell, of the Lowell Electric Light Corporation. The writer gave a word of caution against over-doing the matter of decorative street lighting.

He advocated eliminating the spectacular and in cities with narrow, crooked or shaded streets using tungsten instead of arc lamps. Arc lamps do not lend themselves to strictly decorative lighting, but produce good illuminating results and minimize the number of poles and fixtures on the streets. If economy is imperative, trolley poles may be utilized. It is imperative that the system shall consist of a continuous line of light. Ornamental standards should be selected that carry the lamps in a pendant position to avoid shadows.

He discussed the question as to who should pay the bills, whether private citizens or the city.

The paper is a valuable resumé of the subject, containing a brief description of the systems now in use over fifty cities, mostly in the Middle West, including data as to cost and dimensions, hours of burning, method of securing, etc.



New Books

Lighting Engineers' Hand Book. Compiled by L. R. Pomeroy; size 4 x 7 in., 222 pp. Illustrated. The Safety Car Heating & Lighting Company, New York. $1 net.

This little book, which is neatly printed on a good quality of thin paper and bound in flexible leather, should be classed among the various "pocket books" on technical subjects. As the publisher's name will indicate, it is intended for the use of those dealing with railway car lighting. In addition to this, it also treats of the subject of heating.

There is an introductory chapter on general topics of engineering which contains a particularly well selected and valuable variety of engineering data, both practical and theoretical. Following this there is a chapter on electricity, which is devoted principally to the subject of wiring, with the tables and data most commonly used in this work.

The subject of lighting is the longest section of the book, and deals with both the production of luminants and the use of light. The elementary principles of optics and illuminating engineering are briefly and clearly stated, and there are numerous diagrams which are valuable to the car lighting engineer. The tabular matter, as in the other sections, is uncommonly well chosen.

The other chapters are on steam, heat and heating, traction, pipes and tubes, and hydraulics. A complete index closes the volume.

It is difficult to see how any more useful and practical information could be condensed into a pocket edition than is here produced. The book is a most welcome addition to illuminating engineering literature, embodying as it does a very complete survey of one of its most important branches.

Standard Classification of Construction and Operating Accounts for Electric Light and Power Companies; issued by the National Electric Light Association.

This is the full report of the committee on a uniform system of accounting appointed by the association. While central station bookkeeping does not directly concern illuminating engineers, it is, nevertheless, a collateral subject upon which knowledge may be useful. The efforts of the association to introduce uniformity into methods of accounting and the keeping of statistics is certainly a commendable work, especially in view of the increasing tendency to governmental regulation of public corporations. That the committee has discharged its duties in an able and satisfactory manner is amply proven by the completeness and lucidity with which it has handled this complicated subject.

Editorials.

Tungsten Lamps for Indirect Illumination.

Hotel Lighting.

The Purpose of Street Lighting.

Baseball by Electric Light.

The Lighting of Small Residences; *Electrical World*, September 1.

The annual lighting number of the *Electrical World*, issue of September 1, besides the editorials mentioned later, contains the following articles touching

on various subjects of illuminating engineering:

COMMERCIAL CENTRAL STATION PRACTICE AT HARTFORD.

The discussions of low voltage tungsten and flat rate lighting for residences in this article are of more than ordinary interest. As before noted in this magazine, the Hartford Electric Light Company is the first central station in this country to take up seriously and practically the study of selling light instead of electric current. Its success in this direction has been marked and its experience is, therefore, well worthy of most careful consideration.

STREET LIGHTING PRACTICE IN MASSACHUSETTS.

This is a brief review of street lighting conditions in the following towns: Attleboro, Boston, Brockton, Cambridge, Fall River, Fitchburg, Haverhill, Lawrence, Lowell, Lynn, Malden, Marlboro, Revere, Salem, Springfield and Worcester.

THE TUNGSTEN LAMP IN THE CENTRAL STATION.

Under this title are given the opinions of central stations on the tungsten lamp situation in forty different cities in various parts of the country and one organization operating a number of different plants.

DEVELOPMENT AND APPLICATION OF THE TUNGSTEN LAMP FOR SIGN LIGHTING IN MINNEAPOLIS, by Robert W. Clark.

An illustrated article discussing the commercial and business side of the subject.

LIGHTING OF SCHOOLS; *Electrical World,* September 8.

A general discussion of the subject, giving the latest developments in European countries as well as in America.

FLAMING ARC LAMPS IN TUNNEL CONSTRUCTION, by L. J. Auerbacher; *Electrical World,* September 8.

A brief article giving some of the important tunnel projects in which the flaming arc is used.

ORNAMENTAL STREET LIGHTING IN THE MIDDLE WEST; *Electrical World,* September 15.

An illustrated article particularly valuable for the tabulated information concerning the Western cities in which ornamental street lighting has been installed.

COMPARATIVE LIGHT TESTS OF INCANDESCENT LAMPS; *Electrical World,* September 22.

ELECTRIC LIGHTING OF A BASEBALL FIELD; *Electrical Review and Western Electrician,* September 3.

This describes the recent successful trial of the artificial illumination of a baseball park in Chicago. The illumination is provided by a special design of high power flaming arc with reflectors for directing the light over the field.

DECORATIVE STREET LIGHTING IN SO. BEND; *Electrical Review and Western Electrician,* September 3.

A brief illustrated article describing this installation.

EDITORIALS.

LIGHT TRANSFORMING REFLECTORS; *Electrical Review and Western Electrician,* September 10.

THE ARTIFICIAL LIGHTING OF ART GALLERIES.

THE EFFECT OF RADIATION UPON THE EYES.

ELECTRIC LIGHTING FOR AUTOMOBILES.

The electric lighting and illuminating engineering number of the *Electrical Review and Western Electrician,* issue of September 10, contains the following articles:

PHYSICAL LABORATORY OF THE NATIONAL ELECTRIC LAMP ASSOCIATION.

An illustrated article describing the research laboratories of this organization.

THE COOPER HEWITT LIGHT-TRANSFORMING REFLECTOR.

An interview with Mr. Peter Cooper Hewitt, in which he describes the use of certain aniline dyes in transforming invisible rays of the mercury vapor lamp into visible, particularly red rays.

The Status of Heterochromatic Photometry, by Herbert E. Ives.

A general review of the subject up to the present time.

Lighting the Morgan Art Galleries at Hartford.

The illumination is by tungsten lamps placed above a glass ceiling; diagrams and illumination data are given.

The Quartz Tube Mercury Arc Lamp, by J. G. Zimmerman.

A full description of this new form of the mercury lamp, with illustrations and curves of light distribution.

Applications of the Electric Arc, by A. J. Mitchell.

The intentive of this article, the author states, is to " present a résumé of the developments in arc-lamp electrodes, their influence on the future of the arc lamp, and the utilization of these media for illumination, where conditions from the standpoint of physical or electrical consideration justify their adoption as the logical means of providing the light best suited for the requirements."

The article is illustrated by diagrams.

The Electric Lighting of Automobiles, by Roscoe Scott.

A brief illustrated article on the subject.

Some Recent Tendencies in Street Lighting, by Louis Bell.

Stating that the development of better street lighting has been brought about largely by the new high efficiency lamps, the writer is of opinion that the changes in the method of use have not been such as to bring about the best results, and points out the various faults in their use in street lighting.

An Arm for Tungsten Street Lighting; *Electrical Review and Western Electrician,* September 17.

Gives detailed drawings of a mast arm which can be made in any repair shop of the central station.

Minor Street Lighting at Boston; *Electrical Review and Western Electrician,* September 4.

A comparison of gas and electric street lighting in that city.

Shop and Power House Illumination; *Railway Electrical Engineer,* September.

An illustrated article dealing with the use of the Cooper Hewitt lamp for the purpose mentioned.

Test of an Electric Head Lighting Set, by Prof. H. G. Schmidt; *Railway Electrical Engineer,* September.

This is the report of a test made in the laboratories of the University of Illinois. The lamp tested was a double carbon arc.

Individual Lighting of Machine Tools, by George W. Cravens; *Railway Electrical Engineer,* October.

The opening paragraph of the article indicates the writer's general ideas on the subject:

" The lighting of industrial plants can be accomplished by one or more of three methods: General illumination, group lighting and individual lighting, the former being the most common but least efficient and the latter the most efficient and, until recently, least appreciated."

The paragraph dealing with the false economy of poor lighting is particularly important:

" Take the one item of lost time due to inadequate illumination after dark. One manufacturer of lighting fixtures kept a record of the after-dark output of 21 factories before and after proper illumination was provided, and the averages are very instructive. These 21 concerns operated 480 hours per year after dark, and with improved lighting the output during that period increased nearly 14 per cent., or the equivalent of about 67 working hours per annum. Multiplying this by 622 workmen at an average of 22 cents per hour, we find the saving equaled $9168 per year, as a direct result of increased efficiency of illumination."

The article then discusses the lighting of various classes of machine tools, giving illustrations of special illumination.

Lighting Modern Apartment Buildings, by Ralph Beman; *Building Management,* September.

An illustrated article chiefly devoted to arguments to prove that good lighting of apartments is profitable to the landlords. The following sentence will interest the

gas lighting fraternity: "A change from gas to a modern electric light equipment in one case increased the rent per suite 20 per cent., not to mention the resulting increase in the number of rooms occupied."

ORNAMENTAL STREET LIGHTING; *Southwestern Electrician,* August.

A short article on the progress of the new street lighting in Dallas, Texas. Gives the form of contract blank used in securing subscriptions.

WIRING METHODS USED WITH MAZDA SIGN LAMPS; the *Central Station,* September.

A short article giving diagrams and tables for electric sign wiring.

REQUIREMENTS OF GOOD ILLUMINATION; the *Central Station,* September.

A short article giving a table of intrinsic brilliancies of different light-sources and a table of color values of different incandescent electric lamps as compared with tungsten.

DESIGNS OF ARCHES FOR LIGHTS, by "R"; *American Gas Light Journal,* August 29.

An illustrated article showing various forms of arches on private and public buildings, and methods for their illumination by gas light.

THE WHITE WAY OF WEST NEW YORK, by James Kennedy; *Progressive Age,* September 1.

An illustrated article describing various gas arc installations for exterior lighting in Hoboken, N. J.

COMPARATIVE GAS AND ELECTRIC COSTS FOR EQUALLY EFFECTIVE ILLUMINATION, by Norman Macbeth; *Progressive Age,* September 1.

An article dealing with the subject in detail, giving tables and a chart showing the comparative costs of electric energy and gas for equally effective illumination.

EFFECTIVE HIGH PRESSURE LIGHTING, by L. Kresser; *Progressive Age,* September 1.

An illustrated article describing the Selas high pressure gas lamp and the accessory apparatus required for its operation.

GAS ARC LIGHTING, by E. M. Osborne; *Progressive Age,* September 15.

This is No. 7 in the prize competition series of articles on this subject. It describes a number of gas arc installations, giving illustrations.

LAMPS THAT SAVE POWER AND GIVE MORE LIGHT, by James R. Cravath; *Factory,* October.

Gives a brief description of the various forms of electric lamps, comparing their efficiencies and illustrating their use by photographs taken in different industrial works.

BRITISH SHOP LIGHTING, by James A. Seager; *Selling Electricity,* September.

The writer discusses the commercial methods used by English central stations in securing business.

PHOTOGRAPHIC PHOTOMETRY AND SOME INTERESTING PHOTOGRAPHIC PHENOMENA, by Charles F. Brush; the *Physical Review,* September.

The article describes the work done by the writer during the last two years in developing this method of photometry for special use in investigation. It is illustrated with photographs and diagrams.

ALTERNATING ILLUMINATION, by Dr. Nelson M. Black; *Opthalmic Record.*

A short article discussing an article on the same subject by Mr. A. J. Marshall in a previous issue of THE ILLUMINATING ENGINEER. Dr. Black looks favorably upon the suggestions made by Mr. Marshall.

VISION, by Dr. E. H. Hazen; the *Optical Journal and Review of Optometry,* September 1.

This issue contains Part I. of a series of papers on this subject. The title of the first instalment is "The Situation." The article is written from the optometrist's point of view.

Part II. appears in the issue of September 15, under the title of "Muscular Eye-Strain." The following paragraph is particularly pertinent in view of the articles in this issue calling attention to the fact of eye-strain upon the general health:

"It is very true that eye-strain has the power of making mischief in remote parts of the system by reflex action, and we have an octopus of affections which has for its primary cause "weakness of sight." Indeed this source of irritation is so prominent as a cause of many break-downs in the physical system that it may rival bad diet or unbridled amoursness. . . . I believe the eyes are as great a factor in the culture of the individual as the brain, but of course one hinges upon the other to a great extent, and the better we get at the various causes of weakness of the function of sight, the better it clears up the problem."

THE ILLUMINATION OF STUDY ROOMS, by A. L. Parsons and H. W. Smith; *United States Naval Medical Bulletin,* Volume IV., No. 3.

This is a report of an extended investigation of the systems of lighting in use at the United States Naval Academy. It is profusely illustrated with diagrams, and gives much valuable matter in tabular form. It is probably the most extended study of this subject that has ever been published.

THE REFLECTING POWER OF VARIOUS METALS, by W. W. Coblentz; *Journal of the Franklin Institute,* September.

A highly technical article dealing with the problem of radiation from various metals used as radiants and other metals of the same general order.

Editorials

STREET LIGHTING; the *Canadian Engineer,* September 8.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

THE MEASUREMENT OF LIGHT, by G. B. Barham (*Elec. Field,* August).

STREET LIGHTING CONTRACTS, by K. Edgcumbe (*Electrician,* July 15).

The writer raises some objections to the method of measuring the candle power of street lamps, and basing specifications thereon, advocated by Abady (see previous review). He considers that the mean of measurements at angles of 20 and 50 degrees does not give a good idea of the light yielded by the lamp of street lighting purposes, and prefers to measure at the angles 15 and 25 degrees. However, it is to be doubted whether any measurements at two arbitrarily selected angles can ever give a satisfactory picture of the mean lower hemispherical candle power.

INSTRUCTION IN ILLUMINATING ENGINEERING, by F. K. Richtmyer (*Illum. Eng.,* London, August).

The author lays stress on the need for actual experiments on lighted premises as well as on the photometry of lamps. He describes some experiments on these lines undertaken at Cornell University, including the calibration of a Weber photometer for illumination measurement.

REPORT OF THE LIGHTING OF THE CITY OF LONDON, by F. Sumner (*Official Report of the City Engineer for* 1909).

This report has been discussed in a number of technical papers. It contains data regarding the gas and electric lamps at present in use in London, and also of the experimental lighting by flame arc lamps suspended on wires slung across the roadway. Reference is also made to the report issued by the deputation dispatched to the Continent by the Streets Committee, and a table is given comparing the lighting of London with that of various foreign cities.

ILLUMINATION, ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter (*Illum. Eng.,* London, August).

Contains the results of tests on the illumination of various streets in London in 1892.

DIE ULBRICHTSCHE KUGEL ZUR BESTIMMUNG DER MITTLEREN SPHARIS-

CHEN LICHTSTARKE, by E. Buscher Winkler (*Elek. u. Masch,* August 7).

An article dealing rather exhaustively with the theory of the Ulbricht globe. The author emphasizes the point that this apparatus sums up the light in *all* directions. Other methods of measuring the mean spherical candle power, based on the polar curve, usually assume that the light is symmetrical about a vertical axis which is not often the case. Reference is made to a test of a Holophane fixture with the apparatus which gave an absorption of 6 per cent.

LIGHTING OF THE CITY OF LONDON (*G. W.,* August 6; *J. G. L.,* August 9, 16; *Electrician,* August 5).

Contain comments on the report on the city lighting alluded to above.

THE ILLUMINATION OF FACTORIES AND WORKSHOPS (*Illum. Eng.,* London, August).

A summary of the portion of H. M. inspector's report for 1909 bearing on factory illumination. This was mentioned in the last review.

SYSTEMATISCHE UNTERSUCHUNG UBER DIE WIRKSAMKEIT DER VERSCHIEDENEN ULTRAVIOLETTEN STRAHLEN DER QUECKSILBERDAMPF-BOGENLAMPEN (*Elek. u. Masch.,* August 7).

An account of some researches undertaken to ascertain which portion of the ultraviolet spectrum is most active in destroying bacteria and affecting life. It appears that it is chiefly the rays of very short wave length, such as are absorbed for the most part from sunlight during their passage through the atmosphere, which are instrumental in killing microbes and particulars are given of the time of exposure needed in the case of different organisms.

TESTS ON INCANDESCENT MANTLES, ELECTRIC GLOW LAMPS AND ARC LAMPS, ETC. (*Illum. Eng.,* London, August).

Gives particulars of a series of tests on various lamps, and describes some photometrical apparatus such as adjustable lamp holders, and methods of obtaining the polar curve of light distribution of arc lamps.

REFLECTION IN ILLUMINATION (*Electrician,* July 29).

MESSUNG DER MITTLEREN HORIZONTALEN LICHTSTARKE VON ELEKTRISCHEN GLUHLAMPEN (*J. f. G.,* August 20).

LE PROBLEME DE L'ECLAIRAGE (August 15).

Electric Lighting

METALLIC FILAMENT LAMPS (*Electrician,* August 5).

THE IDEAL ELECTRIC LIGHT (*Electrician,* August 19).

UBER DIE ABHANGIGKEIT DER LICHTSTARKE UND DES EFFEKTVERBRAUCHES BEI WECHSELSTROMFLAMMENBOGENLAMPEN VON DER FORM DER SPANNUNGSKURVE DER MASCHINE UND DER FREQUENZ, by P. Högner (*E. T. Z.,* July 21).

An interesting article dealing with the effect of frequency and wave form on the performances of alternating current flame arc lamps. Distinctly more efficient results are obtained at high frequencies than at low ones, and it is found that a steeply rising current curve is better than one that rises gradually.

INDIREKTE BELEUCHTUNG MIT HOCHKERZIGEN WOLFRAMLAMPEN, by B. Monasch (*E. T. Z.,* August 11).

The author contrasts the results obtained by various systems of lighting, such as direct and alternating current arcs, inverted osram lighting, etc. He finds that indirect lighting by tungsten lamps can, as a rule, compete with arc lamps used in the same way, as far as cost is concerned, and that the light is of a better quality. He adds that both arc lamp and tungsten lamp inverted lighting can compete with the Moore tube system. The article is illustrated by numerous curves and diagrams showing the distribution of illumination.

AVANTAGE DE L'EMPLOI DES BASSES TENSIONS POUR L'ECLAIRAGE PAR

LAMPES A INCANDESCENCE, by L. Rousselet (*l'Electricien*, August 13).

NEUERE BOGENLAMPEN OHNE REGULIERWERK (*Z. f. B.*, August 20).

Gas, Oil, Acetylene Lighting, etc.

PYPHORIC IGNITION DEVICES, by C. R. Böhm (*Illum. Eng.*, London, August).

Gives a historical summary of the efforts that have been made to devise apparatus for kindling flames by rubbing suitable materials together. The best modern pyphoric devices are simply a modification of the old tinder box, the chief distinction being that the metal "cerite" has replaced the steel and "iron stone" of more ancient devices. Such arrangements are now finding extensive use in Germany both for pocket matchboxes and for kindling gas flames, and it is suggested that they may even replace matches to a great extent.

PNEUMATISCHE GASFERNZUNDUNG OHNE DAUERFLAMME, by K. Fritzsche (*J. f. G.*, August 4).

Describes a method of automatically controlling gas lights in which advantage is taken of two distinct methods. The gas is turned on and off by pneumatic means and is then kindled by a piece of metal which becomes incandescent as the gas plays upon it. The method thus avoids the necessity for a pilot flame.

THE DEVELOPMENT OF HIGH PRESSURE GAS LIGHTING (*J. G. L.*, July 26).

CENTRALLY SUSPENDED GAS LAMPS (*G. W.*, August 20; *J. G. L.*, July 26).

The above two articles both deal with advances in high pressure gas lighting. One development has been the extended use of high pressure lamps run off the public mains for advertisement lighting outside shops. Another item of interest is the decision of the city of London to experiment with high pressure gas lamps suspended on wires slung across the street and equipped with means of raising and lowering.

RAILWAY LIGHTING AT BRIGHTON (*G. W.*, August 20).

An account of the new high pressure gas installation at Brighton station. The gas is supplied at 54 in. pressure and a special feature is the use of an automatic kindling device based on bringing a platinum wire to incandescence.

NEUERE LATERNEN UND KANDELABER FUR STRASSENBELEUCHTUNG (*J. f. G.*, August 13).

A summary of new forms of lanterns and apparatus for street lamps.

GASGLUHLICHT MIT BRENNER MIT AUTOMATISCHER LUFTREGULIERUNG (*Z. f. B.*, August 20).

A description of a new form of burner in which the best conditions of combustion for varying consumption and pressure are automatically obtained by means of a ring which expands and adjusts itself to meet each change in the conditions.

BEITRAGE ZUM BELEUCHTUNGSWESEN IN DEUTSCHLAND (*Z. f. B.*, July 30).

DIE ENTWICKLUNG DER KALZIUMKARBID UND ACETYLENINDUSTRIE (*Z. f. B.*, July 30).

GLUHLICHT FUR FLUSSIGE BRENNSTOFFE (*Z. f. B.*, July 30; August 10).

APPAREIL NOUVEAUX POUR L'ECLAIRAGE INTENSIF PAR LE GAZ (*Le Moniteur de l'Industrie du Gaz*, July 31).

Contractions used:
Elek. u. Masch. *Elektrotechnik und Maschinenbau.*
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminating Engineer of London.*
J. G. L. *Journal of Gaslighting.*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The
Illuminating Engineer

Vol. V NOVEMBER, 1910 No. 9

THE RIGHTS OF MAN

Man inherits numerous rights as a perpetual entail from Nature. In the struggle for existence which has given rise to the social fabric which we call civilization, it has frequently happened that the more powerful have assumed control of many of these rights and dispensed them as privileges.

It is no man's privilege to enjoy in peace the fruits of his labor, or to receive a just proportion of the universal gifts of Nature; it is his right. It is likewise the right of every man to enjoy to the fullest possible extent all of the advantages and blessings which arise from the mastery of mind over matter; for the mind of the individual is as much a part of the cosmos, or universal domain of Nature, as is air and sunshine.

The scientific discovery or mechanical invention, once made, becomes the property of all mankind, for the reason that such universal right does not interfere with the enjoyment of all the advantages of the invention or discovery by the individual. On the contrary, the advantage to the individual is dependent upon its use by the many. The electric lamp is no more the property of Edison than was the law of gravitation the property of Newton.

The past quarter of a century has witnessed a remarkable progress in the production and use of light, and every discovery and improvement in this line has enriched the inheritance of man. It is every man's right to have the best illumination that these discoveries and improvements have made possible. If he is not enjoying such illumination in his home he is defrauding himself and his family. If he is not furnishing such illumination to his employees and dependents he is defrauding them of an important part of their birthright.

The remarkable part of the work of science is that the benefits of its discoveries are never forbidden on account of cost; the candle is to-day the most expensive of light-sources. The best illumination is likewise the cheapest; so that he who refuses to supply it for others, or to secure it for himself, commits a folly as well as a sin.

Good light in the home repays a hundred fold in cheer and comfort; proper illumination for the workman returns its cost many times over in the increased efficiency of labor. And so in every other possible case it will be found that the greater the use made of our knowledge of Nature—which is Science—the greater happiness we shall secure, and the more we shall prosper in a material way.

Let there be more and better light.

E. L. Elliott

Compulsory Protection of the Eyes of the Public

By E. Leavenworth Elliott.

Responsibility inevitably carries with it authority. Wherever there is a duty to be performed there is a certain measure of right and privilege for those performing it. It is becoming more generally recognized that the State is responsible for the protection of the health of the citizens to the utmost extent to which such protection can be given. Such measures of protection are limited only by the lack of positive knowledge. The State has no right to experiment in such matters, and can act only within the lines prescribed by fully established facts. Within these lines its duty is clear and its privileges undisputed; for example, no one to-day questions the right of the State to isolate persons suffering from dangerous contagious diseases, and to restrain the personal liberties of such patients to any extent that may be necessary to prevent other persons being infected. It is an established fact that contagious diseases are due to germ growths, and the contagion is simply the dissemination of the germs. The State, therefore, acts entirely within its rights in insisting upon all proper measures for preventing such spread. The supervision of water and milk supplies, of sanitary facilities, of light and ventilation, are means to this end.

Most Cases of Blindness Easily Preventable.

It seems to be a proven fact that the large majority of cases of total blindness are due to germ infection at birth, and are entirely preventable by means so simple and sure that their neglect is nothing short of criminal. There is no question at all that the State should at least require every licensed physician to apply this preventive in every case coming under his professional care. There is no need of dwelling upon the importance of looking after the eyes; sight is the most precious of all the senses in itself, and the relation between the visual organs and the general health is at last beginning to be recognized.

Within the past few years considerable progress has been made toward the systematic examination of the eyes of school children. This is a practice which should be carried out with as much regularity and with greater attention than the yearly examinations in the studies. Free text books and compulsory attendance in schools are wholly inconsistent with the neglect of the health of the pupils. Parents that cannot afford to buy text books are not likely to spend money for the examination of their children's eyes. The misery that has resulted from the lack of such attention is untold, and every case that is neglected in the face of such knowledge of the subject is a far more aggravated case of cruelty to children than many that are vigorously prosecuted.

Manufacturers are rapidly learning that it is the best of business policies to look after the welfare of their employees. Leaving sentiment out of the question, it is even more important to see that the human machines are in good working order than it is to look after the mechanical equipment. In the present perfection of mechanical devices about the only thing that machinery lacks is eyes and brains; and the importance of looking after these is self-evident.

Eyes of Factory Operatives Should Be Examined.

Most large manufacturing establishments now maintain hospital quarters of some kind, with either a trained nurse or a physician, or both, in charge. It would probably be unnecessary, except in the very largest, to employ an oculist, but there is no doubt as to the advisibility of having the eyes of every employee carefully tested, not only at the beginning of his employment, but, say, annually thereafter. Such examinations would accomplish at least

two very important objects; they would avoid all cases of eye-strain resulting from physically defective eyes, and they would be valuable evidence by which to judge of the quality of illumination furnished.

Another condition which systematic examination of the eyes would tend to improve is personal prejudice in regard to illumination. The personal equation is particularly large in judgments of this kind, and the simple fact that the illumination was being worked out on scientifiic lines would have a strong tendency to discourage any habits of mere personal whim in this respect.

Since the State has assumed the authority, by virtue of its duty toward the health of the public, to supervise the sanitary conditions of factories it would not seem to stretch this authority unduly for it to insist upon every new employee either having an examination of his eyes made by a competent oculist or bringing a certificate of such examination. This examination should not only include all the necessary tests for optical or refractive defects, but for perception of colors, normal visual acuity, and general health of the eyes as well.

Half the Studious and Close Working Classes of England Suffer from Defective Vision.

In a paper on "The Eye As It Affects Practical Illumination" read by Mr. John Darch before the Congress of the Royal Sanitary Institute, recently held at Brighton, England, the writer says:

> Defective vision is the outcome of an ill-regulated civilization; and it is estimated that about half the studious and close working classes are sufferers therefrom in one way or another. Insufficient lighting in schools, offices, and workshops is largely responsible for the increase of myopia, astigmatism and many attendant nerve troubles; but, so far as artificial lighting was concerned, the ever-increasing brilliancy and cheapening of light, properly applied, makes the remedy easy.
>
> The need for legislation in respect of adequate lighting has long been felt. Something has been done in the Factory Act Regulations of 1908—requiring that certain rooms shall be "efficiently lighted." Such an expression is, however, indefinite and difficult to enforce, and, until the amount of light to be supplied can be stated in terms of standard units, such legal enactments offer little hope of success. This should present no difficulty, as we now have convenient and portable instruments, known as illuminometers, for measuring and indicating in foot-candles the amount of light falling on a desk, bench, or other surface. They are at present mostly in use by street-lighting engineers; but one should be in the hands of every factory and school inspector, and every architect desiring good, natural and artificial lighting in his buildings.

There should undoubtedly be a much greater overlapping of the professions of the oculist and the illuminating engineer. As a prominent oculist recently stated, nearly all of the investigations of the effect of light upon the eyes and upon the general health have been conducted by electrical or illuminating engineers rather than oculists. The most crying need of the illuminating engineering profession at the present time is more knowledge derived from actual observation and experiment of the effect of different illuminants and different systems of lighting upon the visual organs, and this information can be gained only by active co-operation between the two professions. The sooner such co-operation is begun in good earnest, the better for the professions and the public.

European Nations Recognize the Necessity for Legal Regulation of Illumination.

That illumination is an entirely proper subject for legislative regulation has already been recognized by the most prominent European countries. In the factory laws of France, Germany and England "adequate lighting" is required, but as Mr. Darch points out, this provision is entirely too vague. In Holland the employment of women and children is forbidden in factories in which artificial lighting is regularly required between 9 a.m. and 3 p.m., and it is also provided that in occupations requiring especially sharp vision, as embroidery, engraving, drafting, sewing, etc., a minimum illumination of 1½ foot-candles is specified, and 1 foot-candle for other occupations requiring less careful eye-work.

The Chief Inspector of Factories of Great Britain in his annual report for 1909 says:

> "The importance of adequate lighting is obvious. On the health side it is hardly necessary to point out that inefficient illu-

mination entails risk, strain, and ultimate damage to the sight, or that it tends to the neglect of cleanliness, and adds to the risk of working in poisonous materials."

At the recent second Congrès Internationale des Maladies Professionelle, held in Brussels the past September, Mr. Leon Gaster, who was the official delegate from the British Illuminating Engineering Society presented a paper on "The Hygienic Aspects of Illumination," in which, after referring to what has been done in the way of legal enactment on the subject in other countries, says that the British Home Office is now making a special study of the question of conditions of illumination in factories, and is providing for the collection of data bearing thereon. He says further:

"In attempting to deal with illumination, we must remember that good results can only be secured by the joint efforts of the engineer, the oculist, and the architect. The whole question of illumination depends upon the behavior and well-being of the eye, and the medical profession are, therefore, intimately concerned."

EFFECT OF EYE-STRAIN ON GENERAL HEALTH.

The effect of eye-strain upon general health is a question which has received very scant attention in comparison with its importance. This is undoubtedly due to a considerable extent to the sharp line of demarkation between the professions of the physician and the oculist. A physician's occupation has been too much given to prescribing medicines—a condition, however, which is happily improving. The human body is quite as much a physical apparatus as a chemical laboratory, and the harmonious working of all its parts is to a considerable extent a matter of mechanics.

Dr. F. Park Lewis, who has been energetic in his efforts to secure legislation to prevent the needless sacrifice of the eyes of infants, speaks in no doubtful terms as to the direct and serious effect of eye-strain upon the general health. In a paper read before the Erie County Medical Association in 1904 on "Systematic Examination of the Eyes of Defectives," Dr. Lewis says:

The bearing which that broad term "eye-strain" has upon the functional activities of the system is now so generally recognized that when the physician of to-day finds on making his examination a condition of hyperchlorosis, of sluggishness of the secondary digestive tract, of deficient elimination of urea, or any of the several manifestations of defective working of the human mechanism, his first thought is of a nervous leak somewhere, and his experience has shown him that nowhere is this more likely to be found than in the eyes.

If it can be shown that a large amount of nervous energy is dissipated in the effort to make eyes perform work for which they are organically unequal, and if in connection with this, remote functional disturbances are found, which perhaps in only a few cases cease when the nervous leak is stopped, it is evident that eye-strain may be a contributing, if not an essential cause in the development of neuroses in which these conditions appear and the corollary is self-evident: *The right of the patient in every case to have such an examination made as will assure him of the relief of nervous tension that may be thus obtained.*

The conclusions to which these facts give warrant are, that as nutritive, psychic and mental processes are all unfavorably modified by continued eye-strain, every dull or nervous boy or girl in our schools, every case of incipient pulmonary tuberculosis, every candidate for admission to a State hospital, every child summoned before a juvenile court or sentenced to a reformatory, every reasonably intelligent epileptic is entitled to an examination of his eyes, for while the large claims made of cures which can be no cures, in idiocy, organic brain disease and the like, cannot, of course, be justified, even in these cases comfort may be given; while in the young and impressionable, with normal brain power and organic completeness, but with limited or impaired mentality, the results are sometimes such as to surprise and gratify the most optimistic.

If the effects of eye-strain resulting from physiologically defective vision are so far-reaching and so destructive to mental as well as physical health, there is no escaping the conclusion that eye-strain produced by insufficient, or otherwise defective illumination, must be equally prejudicial in proportion to the eye-strain produced.

Recent legislation in the State of New York requires factories and workshops to supply clean cuspidors. If cuspidors are worthy of legislative regulation, may not artificial lighting claim some consideration on the part of our legislators?

FIG. I.—THE MUNICIPAL PALACE, MEXICO CITY.

The Illumination at Mexico's Centennial

By James Carson.

During the month of September the Republic of Mexico celebrated the hundredth anniversary of its independence. Representatives from all of the civilized countries of the world were in attendance and an elaborate program was carried out, but by far the most important and spectacular feature of the entire celebration was the part which the illumination played.

Mexico City has long been famous as one of the best lighted municipalities of the continent. Electricity is the only important factor used for light and power due to the high cost of steam and expensiveness of wood and coal.

In order to make the electrical illuminations for the centennial celebration at all spectacular it was necessary for the Mexican Government and merchants of the capital to attempt something on a very large scale. In accordance with this plans were made for an installation of more than a quarter of a million incandescent lamps of various sizes. The Government itself used more than half of these while the large department stores and various places of business together with hundreds of private homes took the balance.

FIG. 2.—BUILDING OF THE MEXICAN LIGHT & POWER COMPANY, 7165 COLORED INCANDESCENT LAMPS USED.

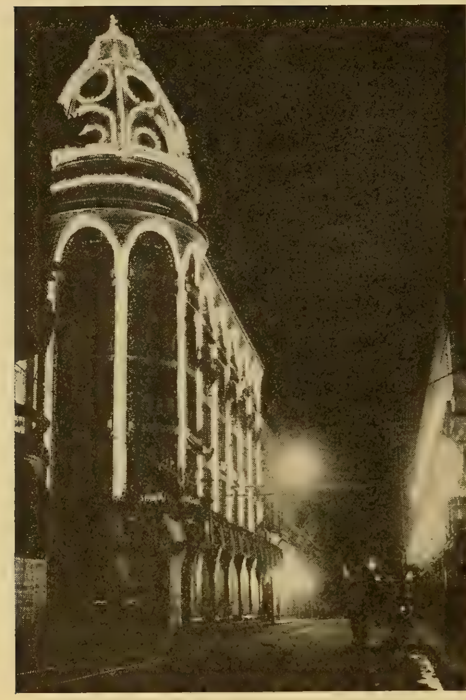


FIG. 3.—A ROW OF DEPARTMENT STORES.

In order to carry this huge extra load the Mexican Light and Power Company were compelled to ask all private exhibitors to use the new 5 watt 12 volt tungsten sign lamps. So successful were their efforts that 136,172 of these lamps were contracted for to burn during the entire month. Besides these small units the Government used 66,258 10 c.-p. carbon filament lamps, 12,195 4 c.-p. carbon filament lamps, 11,742 16 c.-p. carbon filament lamps, 3,010 2 c.-p. carbon filament lamps and 68 of the large tungsten units of 150 and 250 watts. Besides these 126 arc lamps varying from 4 to 13 amperes were used.

The street lighting was carried out by means of special bayonet socket 5 c.-p. carbon filament lamps which were inserted into prepared cables. On important corners these cables were wound about to form arches and other designs. The most notable illumination was that of the three towers of the famous cathedral. This cathedral is older by hundreds of years than the Republic of Mexico and when it blazed forth with 18,800 16 c.-p. carbon filament lamps it was a sight such as never had been witnessed by the Mexican people. Across from the cathedral the front of the National Palace shone brilliantly with 8900 10 c.-p. carbon filament lamps. On the side of it the Municipal Palace was outlined with 6000 10 c.-p. carbon filament lamps. These great buildings formed three sides of the main square of the city. On the other side large department stores burned thousands of lights in honor of the celebration so that in this square alone nearly 68,000 separate incandescent lamps and half a hundred 20 ampere arcs made the plaza as bright as day. Of the private buildings that of the Mexican Light and Power Company with its 7165 colored incandescent lamps was the most elaborately decorated. The decorative scheme of this edifice called for the making of an electric eagle which alone contained 2100 lamps.

The most elaborate spectacles judged from an illumination standpoint, were the Garden Party on the grounds of Chapultepec Palace and the great Centennial Ball in the huge salon of the National Palace. At the Garden Party 20,000 lamps and hundreds of arcs were used

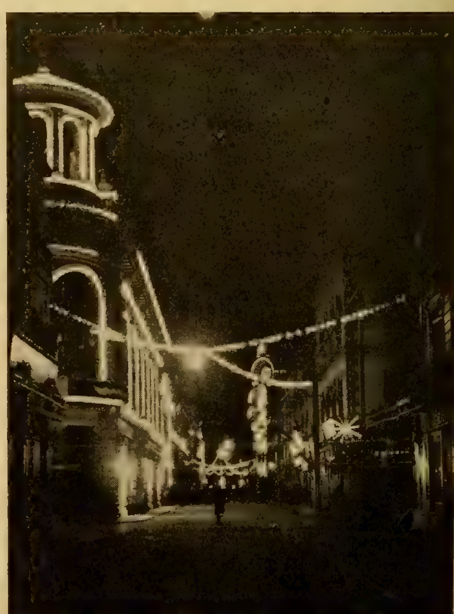


FIG. 4.—CALLE COLEGIO DE NINAS.

FIG. 5.—AVENIDA CINCO DE MAYO, EAST.

FIG. 6.—A BIT OF AVENIDA ISABELA LA CATOLICA.

while an electric fountain of gigantic proportions shot its myriad colors over the waters of an artificial lake. In the ball room of the National Palace 40,000 incandescent lamps and 100 arcs were used. So skillfully were these distributed that at no time during this magnificent function did the light seem too strong. The ball was attended by 10,000 invited guests.

The heaviest extra load during this celebration was carried over the lines of the Mexican Light and Power Company during the night of the ball when 6600 extra kilowatts were registered at the power plant at the foot of the falls of Necaxa, more than 100 miles distant. The entire extra load was carried by the Company's hydroelectric plant without a single interruption of a minute's duration.

Chicago's Lighting to Be Doubled

By Ralph Birchard.

Within the next three years 10,000 arc lamps will be added to the 12,200 now in service in lighting the streets of Chicago. Five thousand of the direct current lamps now in use will be replaced with new alternating current arcs. With a total of 22,200 arc lamps burning every night, the illumination of Chicago should compare very favorably with that of any city in the world.

It is the drainage canal that has made possible this vast extension of Chicago's illuminating facilities. Built originally to solve the sewerage question by using the water of Lake Michigan to wash the drainage of Chicago down through the river to the Mississippi, it is now proving to be of even greater value as a source of power. The dam at Lockport, the southern or lower end of the canal, is the location of a power station which will light Chicago by night and furnish a vast power for use in the street railways by day.

Under the new management the sanitary district (corporate name for the management of the drainage canal) agrees to furnish the city with power for lighting at $15 per horsepower per year plus $1 for each lamp. This will make each arc lamp cost the city about $33 per year. The present operating cost of the lamps lighted by the city from its own power houses is at the rate of $41 per lamp, which, if interest, depreciation, and other charges from which the city is exempted were figured in, would aggregate $66. For each of the 750 arc lamps rented from the Commonwealth Edison company, the city now pays $75 a year.

It is agreed that the city shall turn over

its lighting plants to the sanitary district. The sanitary district will then go ahead with the improvements mentioned, paying for them with the proceeds of a bond issue of $1,250,000. The money will be repaid by the city in seven annual installments. At the end of 10 years Chicago will be the possessor of one of the most modern and complete lighting systems in the world.

The value of the new lighting is greatly appreciated by the police department. Carter H. Harrison once said that "one arc lamp is worth ten policemen." It is well known that criminals love darkness and shun well lighted districts. Thus it is felt that the thousands of new arc lamps will make greatly for law and order in Chicago.

The signing of the contracts for this vast illuminating enterprise was authorized at a meeting of the Chicago council on October 3, when the proposition made to the city by President R. R. McCormick of the sanitary district was accepted by a unanimous vote.

The Lighting of a Large Paper Mill

By J. P. O'Shea.

Industrial lighting presents many different problems. While other phases of illuminating engineering may offer more complicated individual problems involving the art as well as the science of the subject, there is certainly none of its divisions in which there is a wider range of conditions to be met than in the industrial field. From the almost microscopic vision required in certain textile industries and in

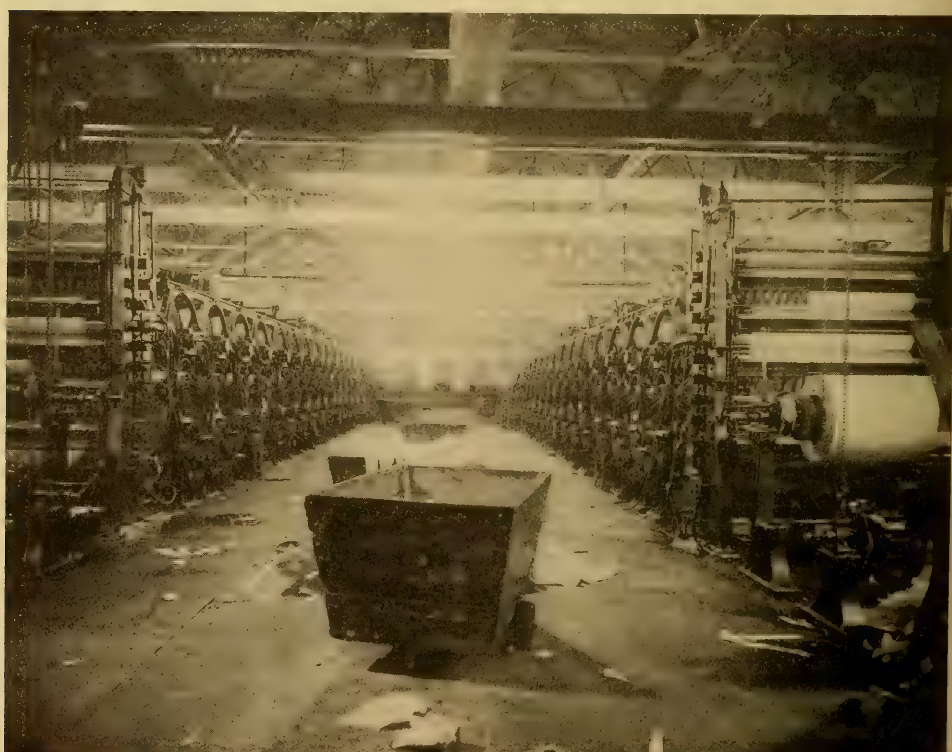


FIG. 1.—MACHINE ROOM IN A PAPER MILL, SHOWING EFFECT OF COOPER HEWITT ILLUMINATION.

FIG. 2.—FINISHING ROOM.

the finest grades of mechanical work, to the necessity of finding one's way about in an atmosphere so thick with smoke, steam and dust that one almost feels like pushing it aside with the hands, there is assuredly room for an almost endless variation of physical conditions and visual requirements.

From the purely engineering standpoint industrial lighting unquestionably comprises by far the largest and most important division of the illuminating engineering field. Questions of art or esthetics do not enter into the problem in any way, thus leaving the illuminating engineer entirely free to work out the illumination in each particular case that is most economical in point of efficiency of the operatives using it, and in cost of operation and maintenance.

The particular problem in this instance is one in which a high degree of visual acuity is for the most part unnecessary, freedom from black shadows and long distance vision being far more important requirements. Paper machinery is peculiar in the great length required in one continuous operation. The paper pulp is pumped up as a thin liquid at one end of the machine and comes out as dry, burnished paper at the other end. Fig. 1 is a view in one of the machine rooms showing two such machines. The paper manufactured here is for use by newspapers and is made from wood-pulp. It is essential that an operative be able to see any part of the machinery or process distinctly from one end of the room to the other. This means that the light-sources must be free from dazzling glare and that the distribution must be such as to prevent sharply defined or confusing shadows. The room shown contains 8000 sq ft. of floor area, and is lighted by 16 type H Cooper Hewitt lamps consuming 192 watts each, a duty of .384

watts per square foot, and a total lower hemispherical candle-power of 4800, or 6 c.-p. per sq. foot. The lighting was previously done with 90 16 c.-p. carbon incandescent lamps consuming 5040 watts, which would give about 630 l. m. h. c.-p. providing good reflectors were used. This is a duty of .63 watts per square foot and .08 l. m. h. c.-p., per square foot. The photograph gives an accurate idea of the visual conditions produced. It will be noted that the details of the machinery show clearly even underneath where they are in direct shadow and that the machinery can be seen distinctly at the farther end of the room. The absence of glare is indicated by the absence of halations about the lamps in the photograph. The workman can readily see to get at any part of the machine without the use of any special or local illumination, the general illumination being practically the same as the best of daylight conditions.

Fig. 2 is a view in the finishing room. The lighting conditions in this case are not difficult to fulfill, a general illumination of modern intensity being required. This room contains 9000 sq. ft. and 8 type H lamps are used, giving 2400 l. m. h. c.-p. and consuming 1536 watts, a duty of .171 watts per square foot, and .27 l. m. h. c.-p. per square foot.

Fig. 3 shows the beater room. The beaters are large vats in which the fibre is ground or beaten up by cylinders running in water. As in the finishing room, only a moderate general illumination is required here. The room contains 9000 sq. ft., in which are installed 6 type H Cooper Hewitt lamps consuming 1142 watts at a duty of .127 watts per square foot and giving .2 l. m. h. c.-.p That the illumination is ample for the purpose is shown by the photograph.

Fig. 4 shows the machine shop, in which repairs and other similar work is done. The requirements are the same as in any other shop using the same sort of

FIG. 3.—BEATER ROOM.

FIG. 4.—MACHINE SHOP.

machines. The absence of confusing black shadows and the ability to see the finest details even better than by brilliant local lighting,—in fact better than by daylight except near windows,—are characteristic of this lighting.

In addition to the above-mentioned rooms the installation includes the carpenter shop, containing 7000 sq. ft. boiler houses, grinding, pressing, screening and digesting rooms, and rooms used for storage purposes. The total number of lamps used is 124, using 217 amperes of current and giving 37,200 c.-p. available light (lower hemispherical). The former installation consisted of 800 16 c.-p. carbon lamps using 400 amperes and capable of giving, when equipped with good reflectors, about 5600 c.-p. in the lower hemisphere.

FIG. I.—NIGHT VIEW, SHOWING EFFECT OF ILLUMINATION ALONG DULUTH'S "WHITE WAY."

Duluth, Minnesota's "White Way"

By H. J. Mullin.

The "White Way" agitation in Duluth was started only a year ago by a few far-sighted and public-spirited property owners who realized not only the direct value of such an improvement to their property, but also the civic importance of a better and more modern system of street lighting. As a result of their initiative, the installation of ornamental electric street light standards has been extended, block by block, until at the present time nearly twenty blocks in the business district are lighted by these standards. Besides this, several smaller installations in other parts of the city have been made, and, before next summer, eight or ten blocks more will be added to the list of well-lighted streets. The expense of installation in every instance has been borne by the property owners proportionately according to front footage.

Our installation consists of five five-light standards to each block on both sides of the streets and four standards on both sides of the avenues which run at right angles to the streets. As our blocks are uniformly 300 feet frontage on the avenues by 400 on the streets, exclusive of sidewalks, this gives a uniform distance of 94 feet on the streets between each standard and 92 feet on the avenues except at the intersections, where the distance is 90 feet, due to the fact that our streets and avenues are 66 instead of 70 ft. wide, sidewalks included. The standards at the intersections, therefore, are placed on the curb line 12 ft. inside the property line on both streets and avenues. This brings (or will bring, as the White Way extends, eight standards at each intersection, four on the street (two on each side of the avenue) and four on the

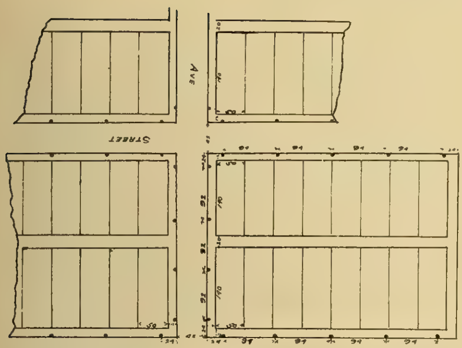


FIG. 2.—TYPICAL ARRANGEMENT OF STANDARDS ON STREETS AND CORNERS.

avenue (two on each side of the street). This arrangement gives a uniformity to the installation which could not otherwise be obtained if only one standard was placed on each of the four extreme intersection corners. By being placed 12 feet from the property line up each avenue and along each street, the corner of the building prevents the street standard being seen from the avenue standard and vice versa (Cut No. 1). Each standard carries five lights, all turned upward. Four of these are on one circuit and the fifth on another. The five lights burn until midnight, when four are turned off and the fifth or center one burns till dawn. One hundred watt tungsten lamps are used throughout, making each standard a unit of 400-candle power. The lamps on the arms are covered by 12-in. roughed-inside globes, and the center one by a 16 in. globe. The five standards on each side of every block are controlled by two "on" and "off" switches, located in the base of the center standard, one switch for the four-arm lights, the other for the center lights. As the lighting company has no system of underground conduits, it has been necessary to chip the sidewalks just inside the curb to a depth of a few inches and lay the conduit in this trench and replace the sidewalk by a cement patch.

The street lighting committee of the Commercial Club had charge of this whole project, and, after working out the above plan for the location of the standards, obtained the passage of an ordinance by the city council making this the uniform arrangement of street lighting standards whenever and wherever installed, so that the owner of this hotel or that theater or store could not arbitrarily place standards according to his ideas and thus destroy the uniformity of the whole installation which is essentially a public improvement

FIG. 3.—VIEW OF SECTION OF INSTALLATION, SHOWING ORNAMENTAL EFFECT OF STANDARDS BY DAYLIGHT.

FIG. 4.—TYPE OF STANDARD USED THROUGHOUT.

though paid for by private funds. This ordinance also provided that no colored globes could be used nor advertising matter of any nature be placed upon the globes, whether it were of an individual character or a part of a general holiday or convention dress-up of the city.

In selecting a suitable standard, the committee who had this matter in charge considered three things essential:

1. The standard should be sufficiently heavy and so constructed as to reduce vibration to the minimum, particularly on street car lines, and should be strong and heavy enough to withstand a little more than the usual wear and tear of the traffic-crowded streets in the business district.

2. It should be dignifiedly ornamental, not so covered with ornamentation as to become tiresome and be difficult to keep clean.

3. It should not be too expensive.

The committee found the task of obtaining a post that embodied these three features more difficult than was anticipated at the outset. Over a dozen manufacturers were written to with the result that eight different sample standards were sent on and set up for inspection, and, finally, after nearly three months spent in this preliminary investigation, the design of standard accepted and installed was chosen as coming nearer than any of the other standards brought to the notice of the committee to fulfilling these requirements. Several hundred of this type of standards have been in use along the streets of Minneapolis, so that a further opportunity was offered to judge the merits of this standard from the experience of our neighbor city. As soon as this matter was settled and the cost per front foot was ascertained within a few cents, active work was commenced to secure the signatures of the property owners to the following contract:

"*Whereas,* The undersigned are desirous of having that portion of First Street between First Avenue West and Fifth Avenue West, in the city of Duluth, well lighted with ornamental electric lights.

"*Now, Therefore,* To accomplish the desired object, the undersigned do hereby agree each with the other that they will each pay their proportionate share, according to the feet frontage owned by them respectively and herein designated opposite their names, the cost of installing ornamental electric light posts, each having five electric lights, five posts to be placed on each side of each block on First Street between First Avenue West and Fifth Avenue West, the same to be placed as designated by the ordinance of the City of Duluth regulating the same."

"*Owner's Name:*"

"*Description of Property:*"

While this is a mutual contract, the property owners were given to understand that the success or failure of the "White Way" would not be dependent upon obtaining the consent of the owners of every foot of property within the limits described in the contract, but that if the owner of seventy-five feet or more refused

to join the standard that would come in front of his property would be left out so that the cost per front foot to the rest would not be raised.

In several instances property owners who at first refused to co-operate came in later when they saw what their position would be in the eyes of their neighbors and the public. It is interesting to notice that no amount per front foot is stated in the contract, and yet the committee had little difficulty in getting the property owners to sign it.

The average cost of the standards set up and ready to turn on the current has been $120 each, or, in other words, four to 300 ft. and five to 400 ft. equals $1.50 per front foot.

The maintenance per standard per year is $55.00, or, in other words, five standards to the 400 ft. equals 68¾ cents per front foot per year. This price includes renewals of lamps and globes, keeping them clean and painting the standards about once a year.

It has been the practice that, wherever possible, the property owner should also be induced to pay this maintenance charge, but, when this cannot be done, to assess it against the tenants. So far, it has worked out that where the property is vacant or has on it only a second-rate improvement the property owner will pay, but, where the improvements are of a substantial nature, the tenants pay this maintenance charge. Within a year or two it is hoped (and steps are being taken to this end at the present time) that the city will take over this entire maintenance cost, as has been done in other cities. It has shown its willingness to coöperate, as far as is permitted by its charter, by taking down the arc lights at the intersections and pay toward the maintenance of this new system of lights what it has been paying for these arcs.

In conclusion, it may be stated that since Duluth started her "White Way" movement a year ago five smaller towns on near-by Iron Ranges have taken up this matter. Two have already made installations, and three are about to let the contracts for the standards and their installation.

Study and Schoolroom Lighting

BY ALBERT JACKSON MARSHALL.

This article has to do with some considerations and suggestions for the lighting and treatment of study and schoolrooms. At the offstart we must consider study and schoolroom lighting as distinct classes of service — one for study, the other usually for recitation.

Inasmuch as study means concentration of thought, the lighting of a study room should be of a nature that the brain will be assisted in such direction — hence, the use of a so-called local lamp which provides suitable illumination on the book or object observed, and a low relative illumination elsewhere in the room. If one endeavors to study in a room which is about evenly illuminated from a light-source, placed in the upper part of the room, a considerably greater effort will be required to fully concentrate thought, than if local illumination be used. A somewhat similar condition is noted when a person attempts to work, mentally, in a large office, especially when alone, when there will be a tendency for the thoughts to become general, expanded, as it were, with the large space, whereas if similar work is attempted in a smaller space, relatively speaking, the thoughts will be considerably more concentrated with much less effort. One may "dream" in a space equally illuminated, but to think the localized illumination would appear preferable. The psyschological, as well as the physiological, phases of these effects afford very interesting study.

In providing local illumination the mistake should not be made of having the rest of the room practically without light, for it is wise to avoid great contrasts. The illumination that would ordinarily be had from reflection from a table on which the lamp would be placed, and from other objects which the light rays would reach,

will usually provide a low order of illumination in the room generally which will not only assist the brain in concentrating, but will also afford a " resting place " for the eyes, which should be " taken " from the observed object occasionally, thus not only permitting a rest, but an opportunity for analyzing the subject being studied.

Some time ago I conducted a series of tests, which have bearing on study considerations, which I set forth in May, 1910, of THE ILLUMINATING ENGINEER.

As regards intensity of illumination desired for study: I am under the opinion that less is needed, partly owing to the contrast between local and low general illumination, than in classrooms, where, usually, the space is more or less uniformly illuminated. One hears, from time to time, statements made as regards the specific intensity of illumination required for this class of work. These figures run from about 1 to 3.5 foot-candles, although such statements are rarely, if ever, accompanied by data as regards the character-color and diffusion of lights that such intensity is related to.

While say 2 foot-candles, obtained through the agency of carbon filament incandescent lamps, appear sufficient, yet 2 foot-candles obtained from average natural light would probably be insufficient. The same might be said of the illumination produced by some other type of artificial illuminants. About three years ago the writer made a more or less rough test in drafting rooms for the purpose of noting the relative intensities of illumination that would give satisfaction to the draftsmen, as obtained from artificial and natural light. These experiments were conducted in a north room, having light walls and ceiling in the afternoon of a clear day. An illuminometer, together with an observer, was placed on and at a drafting table, which table was about 20 ft. removed from a row of windows at the side of the room and was placed in such a position that the maximum light was received from the left. At each of the windows was placed a man, who, acting under instructions from the writer pulled down the blinds very slowly (giving the eye ample time to adjust itself to the difference of intensity received), thus gradually excluding the light until the draftsman felt that as low an illumination as was agreeable to work under had been reached. Illumination measurements were then made. This experiment was repeated with different draftsmen, with different locations of drafting boards, and it was found that the minimum intensity of illumination, as deemed desirable by the draftsmen, varied from 20 to 40 foot-candles. The room was then darkened and similar observations made with Gem metallized filament incandescent electric lamps and the minimum intensity was between 7 and 12 foot-candles. A mere statement or recommendation that 2 or 3 foot-candles is suitable for certain work is of very little value, unless quality of light, treatments of spaces, etc., etc., is specifically set forth.

The so-called " white " light is not necessarily needed for this class of work, in fact the " mellowness " of illuminants, rich in yellow and red, appear to have the advantage. This does not mean that illuminants of a highly selective nature are desirable, for, to the writer's mind, such illuminants as the mercury lamp, with its two brilliant bends of the blue-violet is more or less injurious especially if worked under for lengthy periods.

It will be noted that I suggested in the first part of this article that in studying, one should occasionally look off into the less illuminated space and thus, among other things, afford the eyes an opportunity of exercising themselves and assisting in throwing off the waste products which would otherwise accumulate. In classrooms, especially when illuminated by artificial light, it might be desirable to mechanically bring about such condition by alternating, or changing, the intensity of illumination somewhat along the following lines, which I suggested first in the March, 1910, issue of THE ILLUMINATING ENGINEER.

For classrooms, it would appear, from most investigations and observations, the light should come from one general direction — from the left to right — thus producing a single shadow. This follows for both natural and artificial light. The writer has conceived the scheme of having both natural and artificial light emanate from the same point, thus attempting to make shadow conditions as nearly alike as

possible in the following manner: construct a box-like arrangement, about 3 or 4 ft. deep (from ceiling downward) and of similar dimensions in width (side wall outward into the room) and running the entire length of the left wall at the angle formed by the ceiling and the wall. The wall side of this box-like arrangement to be of clear glass — in other words, we have a window about 3 or 4 ft. in height running the entire length of the upper part of the left wall, with allowances made, of course, for supporting members. Outside, placed at the proper angle, a gathering and reflecting surface. Either at the bottom of the box-like arrangement or the side, opposite the clear glass previously referred to, as may be best suited, place prismatic glass plates which, when they receive the light through the glass side, assisted by the collecting and reflecting outside surface, would re-direct the rays in such a manner that all desks would receive approximately the same intensity of illumination. This box-like arrangement could possibly be equipped with a device which would exclude light, to any degree desired, much like window shades. Inside this box incandescent lamps and reflectors could be placed, with suitable openings to the outside for ventilation, so that when natural light is not available they could be turned on. Windows in schools, as we now have them, *could* be dispensed with. This idea has not been tried out, but is given as a suggestion for a line of experiments.

In the average schoolroom the intensity of illumination obtained on desks next to the windows is usually several hundred per cent. greater than that obtained on desks on the other side of the room. If the maximum intensity is the desired illumination, then the minimum is far lower than is proper, and vice versa. It appears desirable to so equip windows that all *desks* would receive equal illumination.

The walls of classrooms should be treated with a shade, approximating an India tint of dull, unglazed surface first, on account of its physiological nature — affording a restful surface for the eyes — and, secondly, for its high reflecting value. The ceiling should be of a white or cream tint. The desks should be either a fairly dark green (dull surfaced) or of an unglazed oak finish—preferably the former.

All paper used should be of matt-surfaced India tinted order, unless the theory of light tinted symbols on dark backgrounds be used, when the paper would be of a dark green matt-surface, used in connection with amber or India tinted symbols. No books should be permitted in a classroom in which glazed paper was used.

Public Lighting in Hamilton, Ont.

By Thomas F. Kelly.

Hamilton, a progressive city of some 75,000 inhabitants situated on the extreme westerly end of Lake Ontario, has for some time been known as the " Electric City of Canada," a name she has obtained by virtue of her cheap electric power, and the extended uses to which it has been put in public and private lighting, and the operation of factories and railways.

The Hamilton Electric Light & Power Co., Ltd., is a corporation enjoying a public franchise for carrying on the sale of electricity, and has considered it a duty, as well as sound financial policy, to do all in its power to enable the city to justify its possession of this title. Taking as a motto " Electric Service at the Minimum Cost," this corporation has been alert in introducing all that is new and valuable in electric progress, in the firm belief that in persuading the merchant to use an electric sign or to improve his private lighting, in assisting the Commissioner of Industries to secure new factories for the city, assuring low rates and conscientious service for electric power as an incentive, and in a general way promoting the use of this greatest of the servants of man, the company would best subserve the interests of its stockholders and the public from whom it derives its franchise rights.

The numerous installations of decora-

FIG. I.—THE "WHITE WAY," KING STREET, EAST, HAMILTON, ONT.

tive street lighting, popularly called "White Ways," that have been put up in the United States within the past few years have naturally not escaped our attention; and last spring the time seemed ripe for Hamilton to take her place in the line of progress in public lighting. With a desire to benefit to the greatest possible extent by the experience of our neighbors over the line, correspondence was opened with representative central stations throughout the States, and a representative of the company was sent to the convention of the National Electric Light Association at St. Louis to still further investigate the matter. By the end of June the investigation had proceeded far enough to justify us in taking definite steps to give Hamilton a "White Way" of which her citizens might feel proud.

Ornamental lamp standards surmounted by clusters of tungsten lamps in diffusing globes were decided upon as the preferable means of illumination.

The business centre of Hamilton includes about a dozen blocks of King St., which runs through the centre of the city, and adjacent blocks on a number of streets running at right angles to this street.

Figure 1 is a night view on King street east.

Figure 2 is a view of our City Hall showing the lamp standards in place, and also an electric sign which expresses the real feeling of every Hamiltonian toward the stranger or returning citizen.

For those interested in the engineering side of the proposition, it may be said that the standards are equipped with four 100-watt tungsten lamps with diffusing globes, on the arms, and one 125 watt lamp in the central globe. As all our lines are overhead the circuits for these standards are run from transformers situated in the centre of each block. The circuits contain three wires, and are run down the pole on which the transformer is located in conduit to the nearest standard, and

from there distributed to the different standards in conduit placed about three feet below the surface of the pavement near the curb. The lamps of each block are controlled by a switch placed in the base of the standard nearest to the transformer pole. The three-wire system was used so as to permit of the central lamp being run all night, should this be later required by the city council.

The method of creating public sentiment for, and securing this special public lighting may be of interest to the commercial departments of other central stations. We first decided upon the form of proposition to be presented to the merchants, which was as follows:

We proposed to erect standards at each street corner with others at equal distances between of approximately 45 ft. We proposed to install the standards and maintain them in every way, including painting, cleaning globes, replacing burnt out lamps, etc., and to run the lamps from dusk, by which we mean about a half hour before the city arcs are turned on, until 11 p. m. each evening, including Sundays. The merchants or property owners were asked to sign a five-year contract to pay for the current supplied on a basis of 12½ cents per month for each front foot of property on the block. The rate of payment was the same whether or not a particular merchant happened to have a standard in front of his property.

The form of our proposition having been determined, we started to create a public desire for a "White Way." To this end articles were published in all of the city papers setting forth the plans of the company and showing what other cities were doing, and telling what we would do if we received the support of the merchants and property owners along the streets selected to become Hamilton's "White Way." Canvassing for contracts, taking the streets up block by block, was then begun; and while we did not

FIG. 2.—CITY HALL, HAMILTON, SHOWING NEW ORNAMENTAL STANDARDS AND THE ELECTRIC "WELCOME TO HAMILTON" SIGN.

FIG. 3.—GORE PARK, HAMILTON, SHOWING ORNAMENTAL STANDARDS INSTALLED AROUND IT.

have the support that central stations in many other cities have had from local boards of trade, commercial clubs, etc., in less than one month we had closed contracts with merchants and property owners of four blocks.

As soon as the standards had been designed two were ordered and installed in a block where a representative meeting of the merchants of the block had been held and interest first created. The standards were very favorably commented on, and we congratulated ourselves on our fine prospects, in the belief that we should soon have the entire block; but "large bodies move slowly," it is said, and in order to accelerate their motion in this case we carried out a vigorous store-to-store campaign on a competing block, leaving the progressive ones of our first block to convince their more timid and doubtful neighbors that a "White Way" would be a good thing for Hamilton in general, and for them in particular.

As soon as the news was published that the "White Way" was actually started and the standards ordered, our first block was soon signed up and their standards also ordered. Soon after this two other blocks were closed, and then followed contracts for five additional blocks. At this rate before the end of the year Hamilton will have a modern decorative lighting system throughout all the blocks in its principal business center that we originally selected as its electric "White Way."

Besides its prominence as a manufacturing center Hamilton has the distinction of being one of the prettiest cities in the Dominion, being noted for its broad avenues shaded by maple trees, and its fine park system. One of these beautiful shaded parks, situated in the very heart of the business district, is shown in Fig. 3. The proposition to install ornamental lighting standards along the business thoroughfares suggested to a number of Hamilton's progressive merchants the idea of

presenting similar standards to the city to be installed in this park. This public-spirited offer was gladly accepted by the city, and resulted in thirteen of the standards being installed about the outer edge of the park.

These standards are somewhat more ornamental than those used on the streets, the globes being held in the upright position, as shown. The lamps are of the same size, but it is our intention to run the central globe all night. As our contribution toward the illumination of this park we intend to supply the current for the lamps without charge, at least for one year, simply making a nominal charge for the maintenance of the lamps, glassware, etc.

While we have never had any lack of appreciation on the part of our citizens for our efforts to give them good service, and to keep Hamilton to the front as the "Electric City of Canada," we have no hesitation in saying that our movement for the "White Way," which is making Hamilton known as the "Canadian City of Light," has been the most popular move we have yet made. Not only have the citizens at large been favorably impressed by the great improvement which this ornamental lighting system has made in the appearance of our city, but the merchants themselves are beginning to realize, as they have never before, that lighting attracts trade. This will undoubtedly mean increased revenue from additional interior lighting, as well as an extended use of signs, outlining, and other exterior lighting.

Hamilton's "White Way" can, therefore, be considered a decided success from every point of view.

Decorative Street Lighting as a Business Proposition

By Oliver R. Hogue.

The great majority of decorative street lighting installations in use in this country at the present time must be considered primarily as electric signs, for the reason that they have been put up and are maintained by private contributions of merchants and business men for their general advertising value. That such advertising value affords a fair return upon the investment is evidenced by the remarkable increase in such installations and the enthusiasm with which the work of securing them has been taken up by business associations.

No department of central station solicitation is more satisfactory in its results than this, both from the financial and moral standpoints. Such installations furnish profitable outlets for electric current, and their moral effect as demonstrations of the value of good lighting is as valuable an advertisement for the central station as it is to the business interests.

Few people stop to analyze the whys and wherefores of the conditions of public service. To the average mind a dark street means neglect on the part of the public service corporation, while a brilliant illumination produces a general impression of good service and public spirit. It is a happy day for the public service corporation when it can increase its trade and its esteem in the public mind at the same time, and do both legitimately; and this is precisely what the central station achieves in securing decorative street lighting installations.

That Chicago has not been lacking in both the appreciation of decorative public lighting and the expression of this appreciation in numerous contracts for installations is shown by the fact that they have at the present time over 1,000 decorative lamp posts extending throughout 15 different business districts of the city. A typical installation of this kind is the recent one put up on North Clark Street, which consists of 65 posts, each supporting four 60-watt tungsten lamps, which are run from dusk until ten p.m. each night except Saturday, when they are run until twelve p.m. This contract, like others of its class, is for a period of two years at

FIG. 1.—DECORATIVE STREET LIGHTING, NORTH CLARK STREET, CHICAGO.

the rate of $1.50 per post per week. During a recent week we closed contracts for 51 posts on West Chicago Avenue, and have also secured contracts for 50 posts on Thirty-first Street.

We have found that the best method of securing this business is to first confer with the local Business Men's Association as to the number of posts to be secured and the general style of construction to be used. The local association then appoints a committee to canvas the territory and report its work to the company. Our own solicitors, with this information, then canvas the district thoroughly and as soon as we have received subscriptions for 50 or more posts the work of construction is started. We do not consider that less than 50 posts makes a sufficiently attractive installation. On account of the difference of opinion among the business men it is often difficult to have the posts equally distributed. It is natural that each subscriber should want a post in front of his own premises. On this account no exact data can be given as to the candle power per block, as the blocks vary according to the character of the business.

Lighting Large Mills

The Flaming Arc as a Lighting Unit for Large Mills

By F. S. Tuerk.

The development of the flaming arc lamp and its general commercial application to lighting large areas has brought about an important advance in the efficient lighting of machine shops, railroad yards, foundries, warehouses, wharves and convention halls. This form of lamp owes its popularity for this class of service to its great brilliancy, its penetrating power, its low operating expense and its pleasing effect upon the eyes.

It used to be the common practice to hang up almost any kind of a lamp in a hap-hazard way to light a mill, but those days of inefficient light are past, and to-day the mill superintendent recognizes the fact that a well-lighted shop means not only more and better work but contented workmen. In foundries, steel mills and machine shops where the ceilings are high lamps of great penetrating power must be used, because at the present time traveling cranes are used in almost every shop of any size, and in many cases it becomes necessary to hang the lamps above these cranes.

The large machine shops and foundries are generally built with two or three bays, a popular arrangement being one central bay in which the heavy work is handled, and one or more side bays, usually built with galleries in which the lighter and detail work is carried on. Often these side bays also have traveling cranes, and in that case the lamps are hung around the sides of the bay. The upper gallery and main bay, however, are generally illuminated by hanging flaming arc lamps above the cranes. Before the introduction of the flaming arc lamp no solution could be found for successfully lighting these high ceilinged interiors, where dust, smoke and vapor were always present, but in the flaming arc we find a lamp suitable for such service.

For some time the Crucible Steel Company of America, at Harrison, N. J., had difficulty in finding a satisfactory means of illuminating its gun and projectile shop. In this shop, which works day and night, turning out guns and projectiles for the United States Government, good light is imperative. The guns and projectiles made for the Government are built under very rigid specifications, and each shell and gun undergoes very close inspection during the process of construction. It is apparent that without good light much of the work would fail to pass the inspection and thus be rejected.

This shop was formerly lighted by carbon arcs, but these proved unsatisfactory and incandescent lamps were added. These individual incandescent lamps were hung near the various lathes, planers and other machines, and it was thought that this would solve their lighting problem. This combination failed, however, for the men on the night shift were continually having trouble with their eyes. As a last resort flaming arcs were tried, and after a thorough test seven were installed in the main gun shop and three in the adjoining shop. These lamps are run two in series on a 220-volt circuit, and although the voltage is very unsteady, due to the fact that two or three 40 or 50 hp. induction motors are often started or reversed simultaneously, the lamps are operating very satisfactorily.

It is interesting to the illuminating engineer to note the increased production resulting from the installation of these lamps. After the flaming arc lamps had been installed for some time it was noted that the increase in the amount of work turned out by the night shift was a little over 10 per cent. In order to determine whether or not this was due wholly to the introduction of the flaming arcs, the lamps were taken out for a time and the work carried on at night with the old lighting system. It was then found that the amount of work dropped off over 10

FIG. 1.—A FLAMING ARC INSTALLATION IN A CRUCIBLE STEEL COMPANY'S PLANT.

per cent., and that when the work was again carried on under the flaming arc lamps the men were able to produce 10 per cent. more work.

This increase in production is due not only to the amount of light but to the quality. The golden yellow rays of the flaming arc lamp are stimulating in character and very easy on the eyes, and since these lamps have been installed the night men have found it much easier to turn out a greater amount of work than was possible with the old carbon arc lamps.

There is no doubt that the illuminating engineer has an instrument in the flaming arc lamp which will greatly assist him in giving his client a satisfactory means of lighting large areas.

The lighting of foundries has heretofore been a difficult one because of structural conditions, overhead cranes and the presence of smoke and dust. One or two flaming arcs hung above the cranes will satisfactorily light a foundry 50 x 100 ft.

As to the economy of such an installation, the flaming arc stands out prominently as the cheapest illuminant, when we consider that a flaming arc lamp gives 3000 c.-p. at 550 watts, the operating cost is low and so few units are required that the installation and maintenance cost is very small.

FIG. I.—MAIN FLOOR, GIMBEL BROS., NEW YORK, SHOWING EFFECT OF TUNGSTEN LAMP ILLUMINATION INCLOSED WITH C. R. I. BALL GLOBES.

The Last Word in Department Store Illumination

The latest of the gigantic department stores, which have come to be a characteristic of modern merchandising, to open its doors to the public is that of Gimbel Bros., New York City. The building is a thirteen-story structure, three of the stories being below the street level, and is situated between Broadway and the new Pennsylvania Railroad Terminal, between Thirty-second and Thirty-third Streets. The architecture is simple, both without and within, no effort at elaboration having been attempted. The building contains over 26 acres of floor space, and the business is conducted under 390 different departmental divisions. Occupying half of an entire and unusually long block, the store has an extended window space, comprising no less than forty-five large windows.

From the illuminating engineering standpoint the building is noteworthy as being the first case of the kind in which the incandescent electric lamp has entirely supplanted the arc, the entire illumination being furnished by some 7000 tungsten and 900 tantalum lamps, ranging in size from 25 to 250 watts.

Following the architectural features the ceiling of each floor is divided into panels, or bays, 21 x 23 ft., 152 bays to each ceiling.

A typical view on the ground floor is shown in Fig. 1. As will be seen, the illumination here is by four units in each bay. The units consist of 250 watt clear bulb tungsten lamps in 14-in. crystal globes, sand-blasted on the inside, the globes being hung 4 ft. from the ceiling, bringing the bottom 13½ ft. from the

FIG. 2.—SECTION OF FURNITURE DEPARTMENT, SHOWING EFFECT OF TUNGSTEN LAMPS, WITH OPAL REFLECTORS.

FIG. 3.—SECTION OF RUG DEPARTMENT, ILLUMINATED WITH TUNGSTEN LAMPS AND PRISMATIC REFLECTORS.

FIG. 4.—ART GALLERY, ILLUMINATED WITH TUNGSTEN LAMPS AND ALUMINUM FINISHED STEEL REFLECTORS.

floor. The current consumption therefore is at the rate of 48 watts per square foot, and the illumination from 2 to 4 foot-candles in intensity.

The arrangement of lights, while being symmetrical in each bay, is such that there is a row over the showcases and counters in the departments where these are used. In perspective the globes hang so that they run into a single line of light, thus giving the appearance of long illuminated aisles.

The showcases themselves are all illuminated from the upper front corner by the use of tubular carbon filament lamps and narrow metal reflectors. The ceilings are high, and, like the supporting pillars, are finished in white plaster. The cases for goods are unusually low and in common with the counters, are of dark mahogany. This gives an open, unobstructed view throughout the floor, which is exceptionally pleasing.

The single criticism to the lighting here, from the engineering standpoint, is the character of the diffusing globes, which give a distinctly bright spot of light in the center, thus somewhat obscuring and distorting their apparent form. There is no question as to the desirability, at least from the point of general appearance, of a globe that appears uniformly luminous over its entire surface; and as such globes can be obtained as do not give an unreasonably large absorption—in fact, probably not so much as the globes in this case will give, at least after a little use—this criticism seems the more justified.

Fig. 2 shows a section of the furniture department. The lighting here is typical of the majority of the other floors of the building; each bay contains four 100-watt tungsten lamps equipped with one of the recent special makes of opal glass reflector. The photograph clearly shows the high degree of uniformity in the resulting illumination, with the practical elimination of glare.

Fig. 3 is a view in the carpet section.

The illumination here differs from that of the furniture section only in that the lamps are equipped with satin finished prismatic reflectors instead of opal glass. The photograph indicates a perceptibly brighter spot on the ceiling directly above the lamp than in the former case. The illumination below, however, is of equal uniformity.

Fig. 4 is a section of the art department. The lighting here is by rows of lamps suspended just above the top of the picture line, equipped with aluminum finished steel reflectors opening at an angle. The regular ceiling installation has been put in, but only for the sake of general uniformity of construction and for use out of business hours. The illumination of the pictures is excellent, as shown by the photograph; the intensity, though not quite equal at the lower portions, being sufficient for the purpose.

Fig. 5 is a view of one of the show windows. The lighting installation for the windows consists of tungsten lamps, either 60 or 100 watts, according as the goods displayed are dark or light, placed 1 ft. apart along the upper front edge of the ceiling and equipped with aluminum finished steel reflectors opening at the proper angle to distribute the light over the desired space. The amount of light provided is more generous than has usually been the practice, at least before the advent of the tungsten lamp; but it is none too much for the purpose, which is to attract attention and exhibit the goods in the best possible manner after attention has been won.

The general impression on entering the store is of a brilliantly, but not garishly lighted interior; the eye is not distracted by single unduly powerful light-sources, nor confused with too great a multiplicity of smaller units. This last word in department store illumination must unquestionably be set down as a complete success and a justification of the claims made for the tungsten lamp as an available unit for the lighting of large interiors.

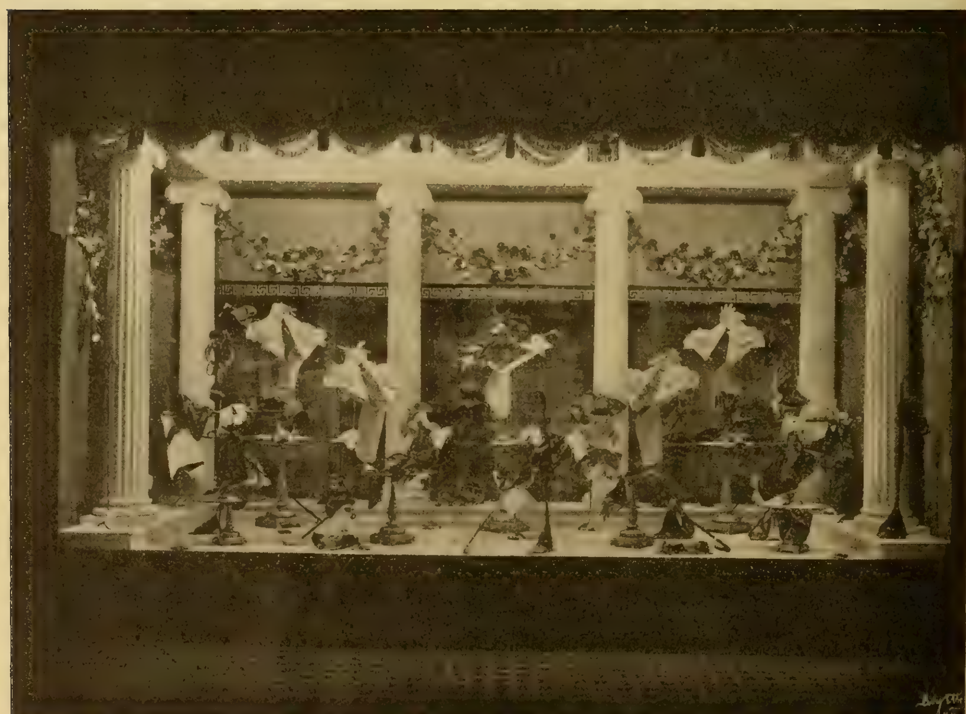


FIG. 5.—ONE OF THE SHOW WINDOWS ILLUMINATED WITH TUNGSTEN LAMPS AND SPECIAL METAL REFLECTORS.

FIG. I.—NEW YORK ELECTRICAL SHOW, SHOWING EFFECT OF ILLUMINATION.

The New York Electrical Show

Of the many shows which are given annually in Madison Square Garden there is none which attracts so much popular interest as the electrical exhibit, which has come to be looked upon as one of the important events of the season.

The show has changed its character considerably since it was first conceived, being now exclusively devoted to such phases of the electrical industry as appeal to the popular audience. Heavy machinery and apparatus beyond the comprehension of the ordinary observer is omitted.

The illumination of the Garden, which is the chief point of attraction for illuminating engineers, is particularly effective this year. The power of the tungsten and flaming arc lamps has been sufficiently impressed upon the public, both in and out of the "Show," in former years, so that there has been no attempt this year to overawe the spectator with the brilliancy of illumination. The entire lighting is by metal filament lamps, the booths being lighted by lamps studded on the dividing partitions, fitted with Alba shades. The general illumination is by chandeliers of unique and unusual artistic design suspended from the ceiling. The color scheme of the decorations is pale green, which is particularly soft and pleasing to the eye.

In the field of illumination there is nothing absolutely new exhibited. Considering the many and important improvements and discoveries in the production and use of electric light which were crowded upon us in the past four or five years, it would be unreasonable to expect that we should continue to be startled with still newer discoveries.

The tungsten and flaming arc lamps, which blazed into glory before an astonished public like meteors, are now perfectly familiar objects, and their exhibition, except in a very general way, only attracts those technically or commercially interested.

In lighting accessories the same general comments hold true. While there is nothing absolutely new presented, there are improvements and novelties in design which show that the manufacturers have by no means been resting upon their oars. The noteworthy feature of these exhibitions is the evident increase in thought and study which the lighting glassware manufacturers have been giving to the subject within the past year. The question of lighting glassware and similar accessories increases in importance with the development of light-sources of higher power and brilliancy, and there is yet room for the display of original genius in this field.

Judging by the crowds in attendance the show has hit the popular fancy and must be considered as a decided success.

FIG. I.—THE EFFECT OF INDIRECT ILLUMINATION IN A GROCERY STORE.

Modern Illumination for Retail Stores

By Augustus D. Curtis.

Nowadays we hear a great deal about scientific salesmanship. The approach proper, the interest created, the desire to possess, the gratification of that desire on the purchasers' part by him, " coming across " with a purchase-all thought out in advance by the keenest brains in the land—the same scientific application of selling principles applied to pills or paper, putty or pottery.

The retail merchant has been working up to this plane of scientific selling for years; unconsciously perhaps, but long before the schools on scientific salesmanship were thought of. The evolution that has taken place in the retailing of merchandise, the application of Yankee ingenuity has revolutionized retailing all over the globe. The merchant taking his stock from out of the boxes under the counter and on the shelves, making his " approach proper " by attractive and artistic window display.

The interest created by the goods shown there and spread out in well-studied exhibition within the store are but the application of the principles of scientific salesmanship, causing the interest to be followed by the desire to possess. The scientific part of this is in the merchant employing the best talent obtainable in the convenient arranging of the store, in the subtle blending of colors in the decorations, in the proper ventilating and heating—for what clerical force can work to good advantage or what purchaser will

tarry to buy anything but the bare necessities, unless all surroundings are conducive to health and harmony? To ordinary observers, however, the matter of lighting has been unsatisfactory, unpleasant and unhealthy.

No line of endeavor or field of research has seemingly been so neglected or handled so poorly as that of store lighting. This is patent to any one who uses ordinary powers of observation. Who has not been in stores modern and complete in almost every detail to have confronting him exposed, brilliant, irritating, blinding lights that not only interfere with clear vision the selecting and matching of goods but shock the most delicate of our organs, the eye, producing a feeling of irritation and perhaps starting a severe attack of headache?

Many of our otherwise perfectly arranged and equipped stores are (unknown to the management, who have never given this close study), doing untold harm to their own working force and the public they have at such expense attracted to their place by the almost criminally careless method of lighting.

An awakening is taking place. Scientific development in the illuminating field is being closely watched by the progressive merchant. New and more comfortable methods of correcting the evils mentioned are receiving the attention they merit.

The illustration, Fig. 1, shows an application of modern methods to a grocery store—a system of indirect illumination by which the brilliant lighting units—a Mazda or tungsten lamp—is covered from view by a scientifically designed reflector of great efficiency and the light reflected to the ceiling at the proper angle to bring it back on the goods displayed.

Here a prospective customer relieved of the annoying glare of any light-source whatever has an unobstructed view of every article in range of vision; the store flooded evenly by a uniform distribution of light; has no dark corners and an hygienic effect is secured. Not only is this lighting method of great comfort to the trade but the clerical force work to much better advantage. Fewer mistakes are made under comfortable lighting conditions. Not only these advantages but work is facilitated, as no shadow is cast by the clerk when selecting goods from shelving, counter or bins. This system is the nearest approach to natural light by north skylight illumination, which, as is well known, is the most perfect lighting possible.

It is necessary, of course, by this artificial method of illumination to have a light ceiling. In this instance the ceiling of corrugated metal is of a very light yellow or cream tint. The walls are green and the shelving, counters and show cases weathered oak.

This is one of a chain of grocery stores being established by the United Food Products Company, who have made a study of and adopted many new features in their stores. The feature that they realize has the greatest advertising value is this modern method of illumination.

The store shown is 14 ft. 2 in. by 54 ft. 4 in.; ceiling, 12 ft. Area, 770 sq. ft. Each of the four outlets has a fixture of three lighting units of the concentrating type of reflectors containing 100 watt clear bulb Mazda lamps, top of same being 30 in. from ceiling. Total watts, 1200; watts per square foot, 1.56. Average foot candles, 3.90. This, as will be noted, is not excessive current consumption and the light intensity more than ample for such stores.

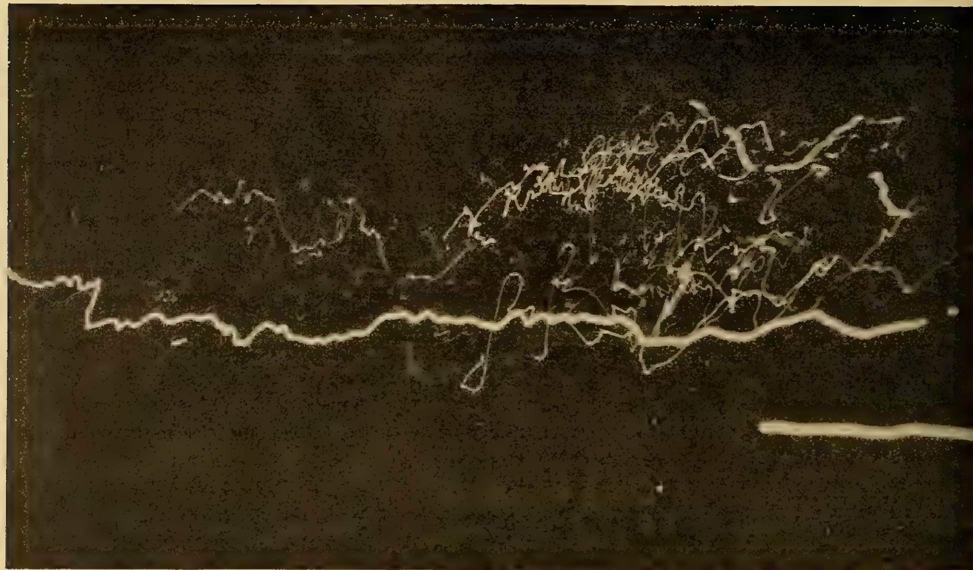


FIG. I.—BROADWAY, NEW YORK CITY, FROM FIFTEENTH STREET TO TWENTY-SECOND STREET. EFFECT OF LIGHTS ON A PHOTOGRAPHIC CAMERA EXPOSED FROM A MOVING TROLLEY CAR.

Relative Glare Shown by a Moving Camera Film

By "The Man on the Street."

We have had "moving pictures" of all kinds, pictures taken of objects moving and stationary, on long sections of film exposing small portions rapidly which when developed and printed on other films, making a positive which when projected with a moving picture lantern will reproduce on a screen the action in the scenes photographed.

The illustrations here given are not that kind of moving pictures, but show the effect on a negative exposed in a moving camera which was directed towards the sidewalk and building fronts. The result on the film is from the lamps in window displays and in front of the buildings. The camera, while one of the ordinary kind, became a "moving camera" when carried on a street car.

Each film was given a similar exposure of 90 seconds at U. S. 8 stop. An endeavor was made to screen off the camera from the headlights on automobiles and passing street cars as well as from the rows of street lamps at each intersecting street.

The pictures were taken from a surface car running north on Broadway, New York, August 18, 1910, at about 11:30 p.m. with the camera directed towards the west side of the street.

Figure 1 from Fifteenth street to Twenty-second street.

Figure 2 from Twenty-fourth street to Thirty-first street.

Figure 3 from Thirty-fourth street to Forty-first street.

Illustrating in a novel manner the building up of street, sidewalk and show window illumination from the lower business section of Broadway, between Fifteenth and Twenty-third Streets, up and into that section known throughout the world as having the highest percentage of light flux per cubic foot of street of any English-speaking community. As the exposures were made shortly before midnight, they are but slightly representative of the business houses and show windows. It should not be assumed, however, that the increased illumination

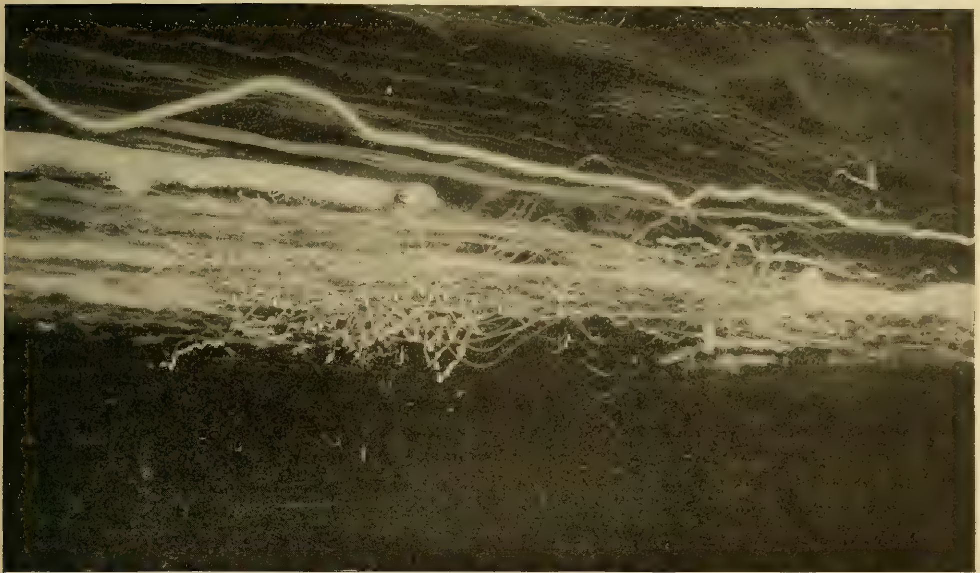


FIG. 2.—BROADWAY, NEW YORK CITY, FROM TWENTY-FOURTH STREET TO THIRTY-FIRST STREET.

may be credited to the " Red Light " section. Red light has little or no actinic value and would not affect the ordinary dry plate or film. This upper section of Broadway may not be devoted wholly to merchandise, but is proven by the camera to be in fact, as in name, the " Great White Way."

Illustrating in a novel manner the change in street illumination from the lower business section of Broadway up and into the " Great White Way."

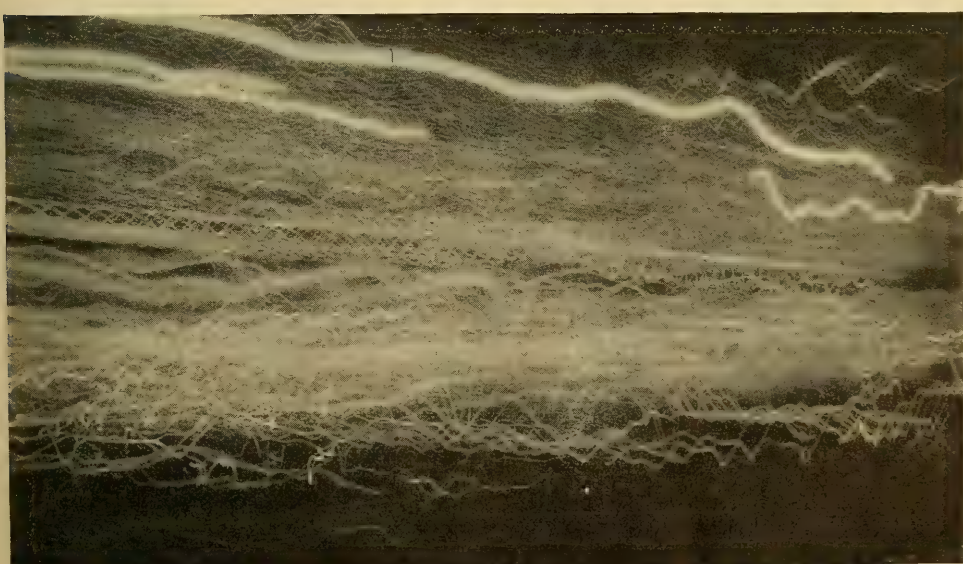


FIG. 3.—BROADWAY, FROM THIRTY-FOURTH STREET TO FORTY-FIRST STREET.

Fixtures and Accessories

Historic Art in Lighting Fixtures

"History repeats itself" says the proverb, and architects and decorators at the present time can certainly never be blamed for any failure of this prophesy. In the rise and fall of peoples and nations the different epochs have left an imprint upon everything that touches the development of man, laws, literature, architecture, art and science. A sufficiently careful examination of any of these imprints will disclose the characteristics of the particular period which gave it birth. Whether we Americans have developed nothing worthy of perpetuation in art, or whether we lack

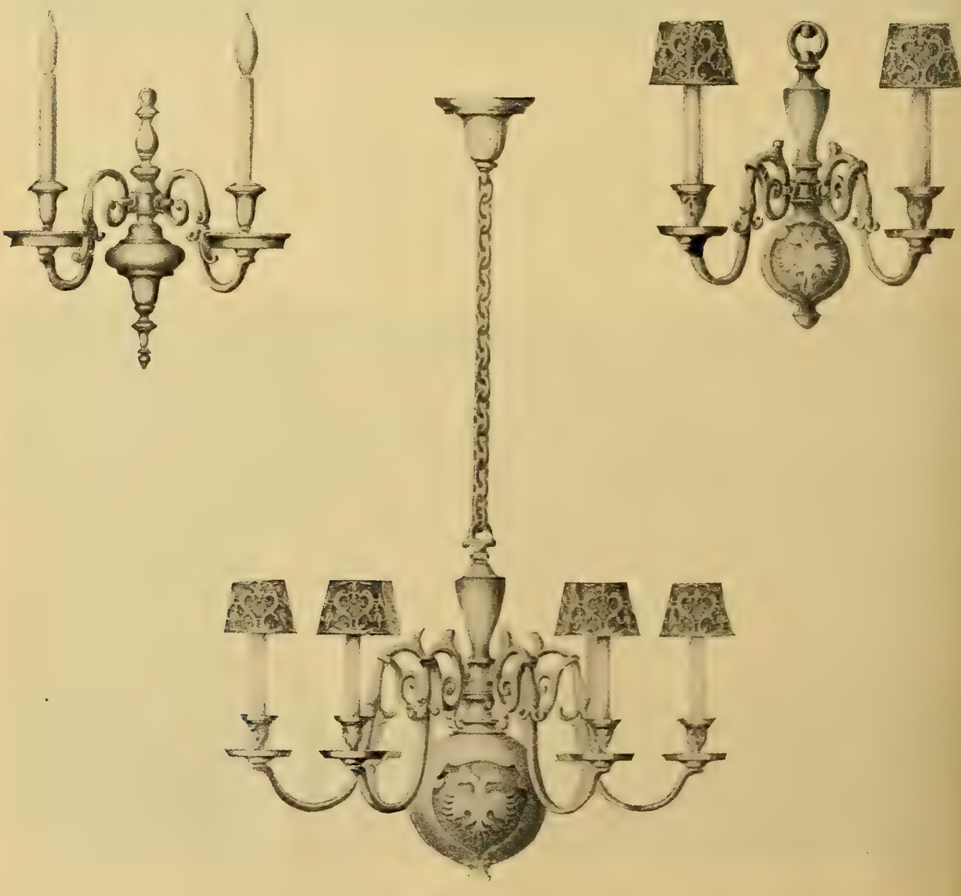


FIG. I.

FIG. 2.

the initiative to create that which represents our ideals of life, or whether we are so much engrossed in material pursuits as to be quite content to reproduce the work of former periods, it would be perhaps rash to say, — unless we take the safe course of attributing our present condition to all of these influences combined. Whatever the cause, the fact is patent that the so-called "period" furnishing is in almost undisputed possession of our decorative art at the present time.

Franklin, in his autobiography, tells how he used to go to hear a celebrated preacher of his day, who was suspected of rather more literal inspiration from some of the sermons of noted English divines than was consistent with the rules of plagiarism; but, with his usual shrewd wisdom, he frankly says that he much preferred to hear a stolen sermon that contained matter worth hearing than an original sermon that contained no new thought. There is much to be said in favor of a faithful reproduction of really good art of the past in preference to crude and meaningless new forms.

One thing is sure, if we are to preserve historic art in modern furnishing, let us have not only the letter but the spirit fully preserved.

In domestic architecture and decorative art it is natural that we should look to the historic periods of the nations from which we are most directly descended; the English, Dutch and French are therefore naturally the predominating influences. In the early period of our history, which may be roughly included in the term Colonial, our art was freely and frankly borrowed from our foreign relatives. Colonial architecture and decoration is simply an American edition of the prevailing practice of these three nations. While the different characteristics were kept fairly distinct in architecture according to the nation from which the particular section of our country received its inhabitants, articles of furniture were much less rigidly separated. At the present time we have still further lost sight of this distinction, and commonly accept the motives of either our English, French or Dutch progenitors with equal grace.

FIG. 3.

FIG. 4.

We reviewed in our last issue some distinctly new designs in lighting fixtures emanating from a Western manufacturer. It is a rather significant fact that a newly issued fixture catalogue reaching us from the extreme eastern part of the country is devoted entirely to fixtures of historic motive, and to the entire exclusion of the slightest influence of the "new art." The underlying motive of all the designs is thus plainly stated in the catalogue: "And so at length it has again become possible to obtain a perfect union of art and science, — to originate, as on the plate pages of this portfolio, designs preserving that fidelity to the beauty and the feeling of the historic periods of which they are examples, — in distinct forms that will meet the exacting lighting requirements of the present day." Any criticism or comment upon the designs must, therefore, in justice be made with strict reference to the expressed motive of their origin.

The subject is treated in the catalogue under four sections, viz.: Colonial, English, French, and Commercial, each section containing a plate showing a typical interior of the period. The fixtures classed as Colonial show the characteristics of three different nationalities mentioned, and also a well defined attempt to work in the spirit of these periods with our modern materials. As would be expected, the simulation of the candle is a more or less frequent motive, but by no means an exclusive one. Different articles of furnishing have also very properly been drawn upon to supply motives; among these candlesticks, andirons, and silverware are particularly available.

Figure 1 shows a chandelier and side brackets in which the candlestick, including the candle, furnishes the motive. The treatment is distinctly Dutch. The large central globe appended to the chandelier is a relic of the counterweight which was used in the actual chandelier to permit of its being lowered for lighting the candles.

FIG. 5.

FIG. 6.

While there is at least a sentimental justification for its presence in the chandelier, it would be much more difficult to explain its purpose in connection with the side bracket; otherwise the treatment is consistent and satisfactory.

Figure 2 shows a chandelier using the oil lamps as the central motive, treated in the spirit of the silver plate of the time. It is an excellent example of faithful adherence to an historic motive while adapting it to special modern conditions. The design would be particularly suitable for a gas fixture using upright mantle burners.

In Figure 3 the motive also follows very closely a typical form used by the silversmiths of the period. The harmony of line, including the glassware, is particularly effective. It would seem incongruous to finish such a fixture in anything but antique silver.

Figure 4 exhibits a more original treatment of the same motive. In general harmony of outline and beauty of curves it would be difficult to conceive a more graceful combination than this, and it may well serve as a demonstration of what can be accomplished by working in the spirit rather than following the mere letter of period decoration. It requires no stretch of the imagination to believe that an artisan in metal, working in the period of our colonial development, might have created this piece had he been put into possession of the modern electric lamp.

Figure 5 may serve equally well as an imaginary product of the Dutch metal worker who delighted in demonstrating the possibilities of the turning lathe in his decorative treatment of lamps and candlesticks. While the fixture declares itself electrical with sufficient sincerity, it so fully retains the spirit of the period as to give no thought of incongruity.

In the English section of the catalogue are shown a number of fixtures in which the decorative treatment is reminiscent of the rich and florid carvings and massive architecture of the baronial halls of "Merrie Old England." In fact, the term "English" is rather too vague as used here, and the types shown might well be styled "Baronial." Figure 6 shows a chandelier in which the motive is taken from the Gothic arcitecture which was characteristic of the "seats of the mighty"

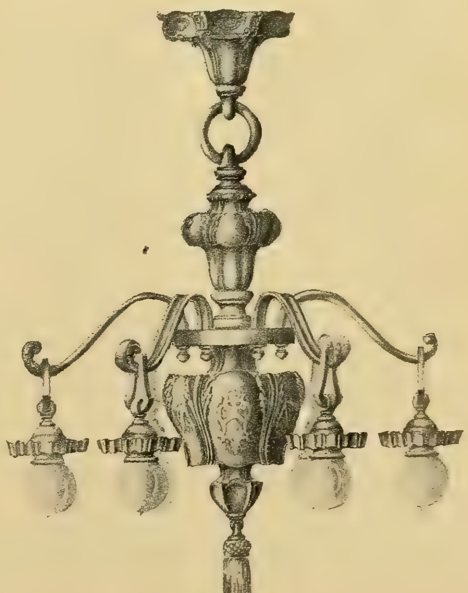


FIG. 7.

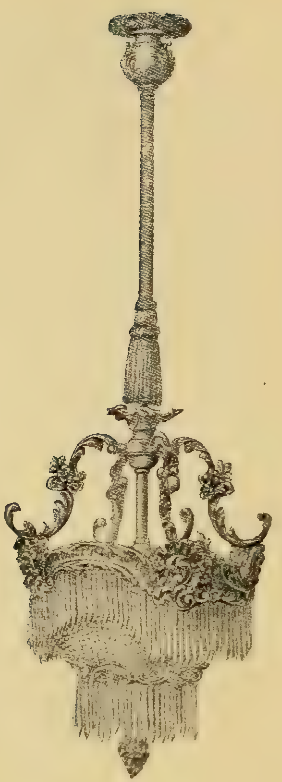


FIG. 8.

in the days of feudalism. The motive is well preserved, and the use of the modern electric lamp harmonized in an entirely acceptable manner.

Figure 7 displays the carving and other characteristics of the later baronial hall; and while the electric lamp in this case is used without any covering whatever, there is not the slightest suggestion of anachronism, so well is the spirit of the period preserved in the general design.

In the French section, as might be expected, there is less display of originality. This is simply an acknowledgment of the perfection to which chandelier construction was brought during the best period of French decorative art. He who would undertake to surpass the masters of that time would indeed need to be a genius.

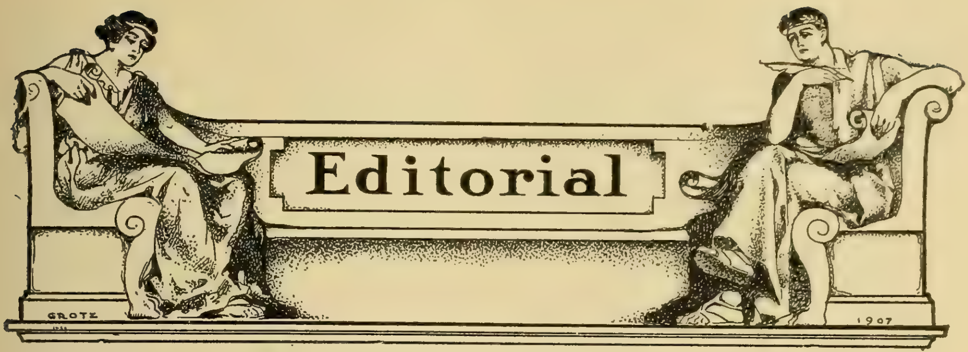
Figure 8 is a piece embodying the well-known features of the rococo decoration of the Louis XV. period, combined with the use of crystal glass.

The commercial section of the catalogue naturally deals with much less pretentious designs, which show a very marked contrast to the conceptions of commercial art in this country a generation ago.

A careful inspection of the most recent products of the fixture manufacturers shows plainly that genuine progress is being made. This is more distinctly apparent if we compare the average fixture of to-day with that of ten or twenty years ago. The incongruities and crudities of the ginger-bread period of American art and architecture, which reached the zenith of its glory about thirty years ago, have largely disappeared. While we cannot conscientiously claim the display of any remarkable degree of creative genius, there are at least mitigating circumstances to be urged in defense of the fixture designer. The fixture trade is fundamentally a commercial affair, and the law of supply and demand comes in as in any other business. Fashions are quite as changeable and freakish in decoration and furnishing as in dress, and a manufacturer is bound to supply in a general way what is demanded by the public.

So long as our architecture is essentially imitative we cannot justly blame either the decorator or the fixture manufacturer for lack of originality. If he displays the true artistic spirit while conforming to the demands of those " higher up " he has undoubtedly fulfilled his mission.

Another point worth mentioning in modern fixtures is the much better class of workmanship exhibited in the construction. Happily, the cast iron or spelter fixture, turned out perhaps in a prison foundry, no longer offends the esthetic sense; and, generally speaking, the use of obviously superfluous ornamentation is a comparatively rare occurrence. The remarkable progress in the production of light cannot help but have a stimulating influence all along the line, and we may confidently expect still greater progress in fixture design and construction in the immediate future.



The Illuminating Engineer

The " Insurgent " in the Politics of Light

From the time when Adam made a failure of his management of Paradise, or when the first talking ape began to build fires, until the present minute there has been an unceasing cry for reform; and the cry is likely to be the last one heard before the final trump.

To re-form is to put a new form in place of the old; but why this eternal demand for change? Is all form an evil, or is it but another phase of the ceaseless motion with which all Nature is endowed? Form, which means an established order of things, needs change for two reasons; because, in the universal scheme of progress, better forms become possible, and because the nature of man is such that forms that have been established for the general good often become corrupt and bad. No sooner is the newer and better order established than the forces of disintegration and debasement begin working at it. Those who are loudest in their demands and most strenuous in their efforts for reform often become the most faithless stewards of the new order which they helped to create.

The most imminent question always is, " Who shall reform the reformers? "

Pessimistic as it may sound, it is a fact, nevertheless, that wherever there is power there will be abuse of power. A wholesome fear of being shorn of power, with all that it means to human ambition and cupidity, is the only safeguard against *de*form—the debasement of established conditions.

There is no stranger phenomenon in human nature than the tenacity with which the beggar clings to his rags and filth, the ignorant and the downtrodden to those who tread upon him. The average human intellect is a sort of moral gyroscope, the more force you exert to push it out of its existing position of equilibrium the stronger the force it develops in opposition; to overthrow him is like overturning a law of nature. " He that is clean will be clean still, and he that is filthy will be filthy still." If this were not an absolute truth the cry of reform would never be heard in the land for the simple reason that every one would accept the new and better form without urging, nay, would seek it out diligently and accept it with joy.

INSURRECTION—OR REVOLUTION?

There be those among us to-day who suspect that not all of the glittering assurances of our politicians are the pure gold of sincere devotion to the public weal, and not a few have had their suspicions aroused to the point of revolt. Hence, the din of insurrection is rattling more or less audibly in our ears. The insurgent in politics to-day is only the eternal reformer under a new name, and he is seeking to reform a great political party that was itself an insurgent scarcely more than a generation ago. A generation hence we may confidently expect the present insurgent to stand quite as badly in need of another political insurrection.

The illuminating engineer is an insurgent in the domain of lighting. He saw that there were many serious abuses in the use of this inestimable boon that science has bestowed upon man, and cried out against them. He saw men working in darkness where they might and could have light in abundance, and he protested. He saw the marvellous improvements which science had wrought rendered useless, and worse, through ignorance, and he demanded the dissemination of knowledge. He pointed out the sinful waste that impoverished both purse and health. He sought to establish a new and better form of lighting in place of the old, which had failed to utilize the improvements in science and had become debased by many abuses.

"Why," said the French monarch to his minister, when the soldiers refused to obey his command, "this is insurrection!"

"Sire," replied the minister, "it is revolution."

When THE ILLUMINATING ENGINEER, some five years ago, began to handle the subject of lighting regardless of the dictates of custom, its action was that of an insurgent. To-day it can say of illuminating engineering, "It is a revolution!"

A political insurrection becomes a revolution when its authority is recognized by other governments. Illuminating engineering has been recognized as at least in possession of its field *de facto,* and its authority recognized and respected by other professions accordingly.

THE LINE OF MARCH.

But there is yet much to be done to establish a complete system or form of the science, and to bring all of the varied inhabitants of the lighting field into allegiance. The production of a unified and vigorous nation from diverse tribes having certain interests in common, but with individual tastes and objects, is a matter of growth along lines of mutual compromise. This must be true of illuminating engineering if it is ever to come in full possession of its possible power. There is a place within its domain for every kind of illuminant and every form and shape of accessory that the mind of man can devise; and every one of these must be given all the power and privileges that its worth demands, but not one scintilla more. The field of illuminating engineering must not become a private preserve for the profit and amusement of any lord of the lighting industry, nor a territory to be parcelled out to the several "interests."

The Illuminating Engineering Society represents, or should represent, the profession or science for which it stands. It occupies the position of a representative body, and its actions will be taken by the public as those of the profession at large. If it is conducted along the impartial and sound ethical lines that are maintained in the older professional bodies it will inspire confidence and respect in this new science and profession. But impartiality is not precisely the same thing as a division of territory according to the relative commercial power of the different interests; in fact, rather the reverse of this is true. The commercially weak is frequently the morally or scientifically strong, and, therefore, the more entitled to encouragement.

One of the chief reasons why the reformer eventually himself needs to be reformed is that those whose selfish interests suffer by the reform, when they find that it is useless to openly oppose the movement ostensibly espouse the cause, but covertly work to direct its movements so that it will play into their hands. The Illuminating Engineering Society, occupying as it does the position of a reformer, is not immune from such attacks.

LET US HAVE "THE WHOLE TRUTH."

It is a very wise provision in the form of oath required in the giving of legal evidence that it be "the whole truth" as well as "nothing but the truth." It is quite possible by suppressing a part of the truth to give an impression that is essentially false. This is one of the chief methods available for those who seek to divert the stream of reform into such channels that it will turn their own water-wheels. What is said can be put to the acid test of proof and its truth or falsity made plain: that which is unsaid is difficult to discover, and more than

likely to remain entirely hidden from the casual observer or layman. The very essence and spirit of science is to determine not only the absolute truth, but the whole truth so far as possible. Any scientific treatise or paper to be worthy of the name must be quite as diligent in its exposition of facts or phenomena which tend to contradict or oppose the main purpose or the theory set forth; nor must the full exposition be left to the efforts of the author, but his paper must be put upon the dissecting table and subjected to a merciless probing by all hearers. Discussion is to the scientific paper what cross-questioning is to the legal trial. Tacit understandings that certain phases of subjects are to be glossed over, either in the writing or discussion of papers, are a deadly form of opiate in the treatment of scientific progress.

The illuminating engineering profession has much to say about "letting in the light" in the physical sense; it should be equally solicitous to let in the light in the moral sense. It is to be expected that human nature will not differ materially, whether in the form of the illuminating engineer or other professional calling, and both the profession and its organized exponent may be expected to exhibit the usual characteristics. There is no denying the fact that several idiosyncracies have been manifest to some extent in its conduct. Probably it has suffered as little as any other reformatory movement.

PROSPERITY VS. PROGRESS.

As eternal vigilance is the price of political liberty, so is it essential likewise to scientific progress. Smug prosperity is by no means an evidence of innate virtue. A comfortable balance in the treasury and a corpulent membership roll are not of themselves proof of the highest type of progress in science and influence. It is the actual work accomplished in the way of improving lighting conditions that measures the real value of the Society; by this test alone must it stand or fall. A large membership may possibly be a means to this end, at least it *should* be, otherwise it fails of its purpose. The Society has not only passed its period of struggle for existence, but has acquired actual opulence. This is the strongest additional reason why greater vigilance and effort should be exercised in stimulating original work and the systematic development of the science of illuminating engineering. There is no lack of undiscovered country, or new territory that needs mapping.

The statement is still made that illuminating engineering is not an exact science. It is time that it either gave substantial refutation of this statement or accepted it, and assume the role of a speculative science. It is either one or the other.

The facts must be ascertained with all possible care, and the conclusions logically drawn without fear or favor. If a certain light-source or accessory or method of use is demonstrated to be superior to others for some particular purpose or class of uses, then let that fact be accepted and such use become standard. Exactness demands that the *whole* truth be known, and not only known but acted upon. Illuminating engineering can never become an exact science until its practice is based upon an absolutely impartial treatment of the materials and facts with which it deals.

The instruments for measuring photometric quantities have been brought to as high a degree of perfection as those commonly used in other professions. The only remaining source of inaccuracy is in the physiological effects of illumination. In this respect there is much work to be done. There is at present a marked diversity of opinion as to the effect of different systems and different illuminants, and only an investigation along the usual rigid lines of science can afford the grounds for safe conclusions.

Color of Light as a Factor In Illuminating Engineering

The justification for the segregation of lighting problems into a distinct science and profession lies in their number, complexity and importance. So long as a flame was the only available source of artificial light there were not sufficient materials for such a segregation. It was the advent of modern illuminants, with their varied and distinctive qualities, that

is chiefly accountable for this specialization. One of the most apparent of these qualities is color, and each advance step in the science of light-production increases the importance of this problem by adding to both its extent and effect.

The prime object sought by all experimenters in the field of light-production is unquestionably a higher efficiency. This means the production of light at less cost; and it is a reasonable hope of the discoverer or inventor to secure a part of the saving which his work insures.

Since we have not yet passed beyond the stage of using heat as the immediate cause of light, the larger part of all the improvements thus far consists simply in a means of maintaining an incandescent body at a higher temperature. Following a natural law, this has resulted generally in the production of light containing a larger proportion of the blue and violet rays and consequently more nearly approximating sunlight.

It is quite to be expected that an inventor will advance every possible claim for advantage in his invention, and still more may this be looked for in its commercial exploitation. Since it has happened, from natural causes, that most of the newer light-sources give a nearer approximation to so-called "white light," the many arguments in favor of the advantages of such light follow as a matter of course.

EVOLUTION OF THE HUMAN EYE.

"The eye has been developed in the process of man's evolution to work by daylight; consequently daylight must be the perfect light." This sounds like a statement of an axiom. But before accepting any statement as self-evident truth care must be taken to peer around the corners and see if it looks the same from all angles. To begin with, it will not do to swallow all evolution arguments without mastication; in fact, there are not a few of them that need to be thoroughly Fletcherized. Even if we accept the theory in the general sense, it must not be presumed that the evolutionary process has ceased, nor that the human mechanism is perfect. The familiar quotation from Professor Von Helmholtz will bear repeating, which is to the effect that were an optician to bring to him an instrument containing so many imperfections as the human eye he would be entirely justified in refusing to accept it. In other words, the human eye is inferior to the optical instruments built by man. This being the case we need not be too much in a hurry to assume that natural conditions are always best for its use. The fact is we have to help it out in many ways— with glasses, prisms, reflectors, shades and what-not.

But leaving this argument for the time, let us return to the evolution theory. The trouble with the supposed axiom in regard to the development of the eye is that the premises are not true. The eye has not been developed entirely by daylight. Ever since man learned to use fire he has used artificial light, and no small part of the use of the eye has been by the light of flames. In the earlier stages of its evolution moonlight and starlight have been factors to be reckoned with. That all these conditions have been effective in developing the human eye to its present state are shown in its ability to work with a fair degree of success under a wider range of conditions than any other sense organ. The difference between noonday sunlight and the light of the full moon is more than a million to one, and yet the eye can see with comfort and distinctness by both; and even these do not measure the limits of its range. Furthermore, both the quantity and quality of natural light are constantly varying, and this condition should not be overlooked in any consideration of the evolutionary theory of its development. The suggestion to reproduce these variations to a certain extent in artificial illumination has met with approval by some of the most competent opticians.

Not only does daylight vary in intensity but in color as well, from the blue-white of direct sunlight, or light from a blue sky, to the deep orange of twilight. To subject the eye continuously to white light taken from "average daylight" as a standard, far from being an ideal condition, would undoubtedly prove both uncomfortable and injurious. To reproduce the changes represented by the actual conditions under which the eye has developed, namely, from blue-white to orange-

red light, would represent a far more logical deduction from the facts in the case.

COLOR A RELATIVE QUALITY.

The chief reason assigned for the superiority of white light is that " it shows all colors as they naturally appear." This means simply that it shows colors as they appear by " average daylight," and entirely overlooks the fact that color is not an absolute but a relative quality, and is of esthetic importance only. The person who is totally color-blind could maintain his existence quite as well as the person with the most color-sensitive eyes. The entire color scheme may be changed, just as the tone scheme of music may be changed by transposing to a different key, without interfering with the general effect. Is the landscape less beautiful in the warm, amber light of sunset, or the pearly pink of dawn, than it is at noontime? Is the scene presented by the varying colors of decorations and costumes in a ballroom less attractive by " gas-light " than it is by day? Do we not purposely shut out the daylight on many occasions that we may transpose its relentlessly hard color scheme by pitching it to a softer and more melodious key? To " turn night into day " may be admissible when it is for the purpose of continuing the labor of day, but what earthly excuse is there for reproducing the conditions and surroundings of our daily toil through the leisure hours of the evening?

WHITE LIGHT UNNECESSARY FOR DOMESTIC USE.

Whiteness may be a virtue in a light intended for industrial purposes, but it is by no means so for use during the hours of rest and recreation. A pure white light is positively undesirable in the home. It is unnecessarily fatiguing to the eye, brings out blemishes and imperfections that were far better hidden, and is too suggestive of the toil and strife of the day and the outside world. The human eye was never developed by daylight within the abode of the family. Glass windows are a modern invention. From the cave-dweller to the modern scientist man has sat by the firelight in his own home. Doubtless this long evolutionary process is responsible for the fascination which the flame still possesses for every normal human being.

So far as domestic lighting is concerned the problem for the illuminating engineer is not how white a light-source he can find, but how he can subdue the whiteness of the most modern lights so that they will be acceptable from the esthetic and psychological viewpoints. Fortunately there is comparatively little loss in the visual power of light by quenching a sufficient portion of the blue and violet rays to reduce it to the soft amber, or orange color, of the flame. While we may accept sunlight as standard for commercial daylight use, the flame is just as accurate and acceptable a standard for domestic and social use.

A new incandescent gas mantle is announced, which produces a light of amber tint. This is a timely recognition of the desirability of retaining the flame standard of color for domestic use, and is a distinct move in the right direction. A table lamp designed for utilizing the new high-efficiency incandescent electric lamps has also appeared which is provided with a resistance in the base, which acts as a " dimmer," not only in lowering the intensity but in changing the whiteness of the light to the warmer, amber tones, thus affording not only the desirable color of illumination, but of varying both color and intensity from time to time so as to reproduce more exactly the conditions of daylight illumination.

COLOR NOT IMPORTANT IN INDUSTRIAL LIGHTING.

Even for industrial and commercial purposes the necessity for white light is far less urgent than is popularly supposed. The entire demand in this respect is confined to the cases where colors must be compared that are afterward to be principally seen by daylight. We may at once exclude every industry connected with the production and manufacture of the different metals. The manufacture of articles from wood, leather and plastic material may likewise be set aside. This leaves the textile industry as the only great field of labor, supplemented by the more limited industries of printing and paper-making; but even in these the proportion

of operations requiring color distinction is but a small fraction of the total. Aside from the specialized industries of dyeing and color printing there is probably not one in a hundred of the operatives in these industries that has any occasion to distinguish colors by their daylight values.

Color in such cases is of interest only as it affects acuity of vision. In view of the very great difference in color of different commercial light-sources at the present time, their effect upon acuity of vision is an exceedingly important matter to illuminating engineers in all cases where the eye is called upon to distinguish fine details. It is now a well-established fact that bluish-green light, or light devoid of red, is highly conducive to visual acuity; and unless it can be positively proved that such light has some deleterious effect to offset this advantage — a fact for which there is no sufficient evidence thus far — then light of this quality must have a decided preference for all practical purposes where acute vision is required.

The question of color is but one of great and increasing importance in the science of illuminating engineering, and demands more careful and considerate attention than has yet been accorded to it.

Eye-Strain as a Factor in Moral Conduct

When the organs of vision are strained by overwork under improper conditions they enter their protest in the same manner of the other organs of the body, namely, by the sensations of fatigue and pain in the organs themselves. This should be sufficient notice to the individual to remove the conditions producing these ill-effects. But the mere aching or burning of the eyeballs is not a sufficient admonition in many cases, and the worst feature of it is that the discomfort of the eyes themselves may be a small part of the actual evil effects produced. The "sympathetic strike" is a common occurrence in the economy of the human body, and the organs of vision are so intimately connected with other important nerve centers that it is impossible to overwork them without sympathetic action in other directions.

In all probability modern civilization is still in a state of barbarism in respect to its treatment of criminals. It is not so long ago that the insane were treated as outcasts and were left to their own destruction, if not to actual abuse. The criminal is manifestly an abnormal individual, and there is no other test for sanity than conformity to general modes of thought and action. Society will some time treat the criminal as a pathological case, just as the insane are treated to-day; and doubtless a still larger proportion of cures will be made by methods worked out from the scientific study of physiology, anatomy and psychology.

Insanity may be, and is commonly produced by various unusual strains upon either the physical or nervous systems, and there are well-authenticated cases where it has resulted from the nervous strain resulting from attempts to use eyes that were optically imperfect. If such total aberration of the intellect may result from severe eye-strain, it is not at all surprising to find that a lesser disturbance of the mental equilibrium, evidenced by vicious actions, should result from a lesser degree of eye-strain.

We published an article some months ago describing an experiment made upon an American schoolboy, who had been directed to wear glasses. A careful attention to the conditions under which he used his eyes both by natural and artificial light soon not only enabled him to discard his glasses but produced a very marked change in his conduct; while he had previously been irritable and given to fits of anger and disobedience, he became wholly tractable and equable in his disposition when the irritating eye-strain had been removed.

Another case of a similar but rather more pronounced character was reported from the psychological laboratories of the University of Pennsylvania.

It is said that violet light is used in Russian prisons as a means of torture and of destroying the mind, both of which purposes it accomplishes. While too much credence must not be put upon such hearsay, it recalls a case in this city where blue light was used in a nickel theatre for some purpose and the management found it impossible to keep their help but a few days at a time; they would

soon become irritable and quarrelsome, and then leave. When the use of the blue light was dispensed with there was no further trouble of this kind.

There is urgent need of a better understanding of the effect of eye-strain upon not only the health of the body but of the mind as well.

Meeting of the American Gas Institute

The fifth annual meeting of the American Gas Institute will be held in the auditorium of the United Engineering Societies Building, 29 West Thirty-ninth Street, New York, commencing Wednesday, October 19. Among the papers to be presented, which include a large variety of subjects covering gas engineering, there is one of interest to illuminating engineers—"The Lighting and Ventilation of Gas Appliances of Display Rooms," by Thomas Scofield.

An exceedingly attractive entertainment programme has been provided, one event of which is the visit to the New York Electrical Show at Madison Square Garden. The only thing remaining to make the meeting a success is a large and representative attendance, and this is "up to" the gas companies; the Institute has done its part.

Notes and Comments

Some Interesting Developments in the Progress of Public Lighting

SHOULD THE MAINTENANCE OF DECORATIVE PUBLIC STREET LIGHTING BE A PUBLIC CHARGE?

The two most noteworthy developments in the lighting field chronicled by the daily press during the past month are the efforts being made by cities in which extensive decorative lighting systems were installed by private subscription to have these installations taken over by the city, and the extension of public lighting into suburban and rural districts.

The first of these movements is one of the inevitable results of the general rush of cities and towns, mostly throughout the West and Middle West, to create "White Ways" as private enterprises. While each city and town in turn has, of course, claimed to be "the best lighted city of its size in the country," there is no doubt that Minneapolis has been one of the acknowledged leaders in the new decorative lighting. Its system is now extensive and of a high order of merit. Nearly the whole of this system was put in and has been maintained by private subscription; but the subscribers apparently think that the time has come when they should be relieved of supporting this public enterprise. They are consequently making a strong appeal to the city authorities and the people to have the maintenance of the system hereafter made from the public treasury. The main arguments put forth in support of this proposition are that the increase in real estate values brought about by the decorative lighting will more than pay for the maintenance of the lamps by the additional taxes received, and that the lighting is a benefit to the city at large, and consequently should be paid for the same as other public works.

On the question of the rise in real estate values due to the lighting, Mr. Harris, president of the Publicity Club, to whose efforts the installations are largely due, gives a detailed estimate by blocks, and concludes that the total rise has been at least 10 per cent. In an interview with the *News*, Mr. Harris says:

"I believe that my rate of 10 per cent. in increased value, owing to the influence of the lights, is most moderate. I know of several cases where property held at a certain price before the installation of the lights has since been sold at more than double that figure."

Mr. Harris has lost none of his enthusiasm for the new public lighting, as the following interview with the *Journal* shows:

"Instead of fearing the added expense in-

cident to the extension of the ornamental street lighting system, the city should look on it as a great opportunity to be improved. If we had 1000 lights to-day instead of 507, the city would be just that much more the gainer, not sentimentally, but actually.

"I have not placed any estimate on the general advertising and publicity the city secures. I am trying to show that these lights, instead of being an expense to the city, are actually a source of revenue."

As illustrating the unexpected and minor advantages of better street lighting, it is asserted that the merchants on some of the streets before the new lighting was put in were unable to obtain plate glass insurance.

Dallas, Texas, which is accorded with being perhaps the best lighted city in the extreme Southwest, is taking a long-sighted view of the new lighting and is arranging a contract by which the private citizens putting in the installation will be assured of its continuance by the city at a later date, according to the *Times-Herald:*

"As soon as the full amount of money necessary to pay for the lighting for a year has been collected the city of Dallas will take over the new lighting contract for the Elm street business section.

"Under the proposition made by the business men they are to pay a sum sufficient to run the new gas lights for a year, with the understanding that the city will keep the lights up after that time, taking over the contract."

Sioux City is also looking in the same direction, as the following from the *Journal* indicates:

"Through the agency of several business men a proposition will be presented to the City Council wherein that body will have the prerogative of taking over the system of street lighting electroliers which recently have been installed at the expense of individuals in exchange for keeping up the cost of maintenance and operation.

"The merchants now are paying the cost of the power consumed in addition to the original outlay for the electroliers of $100 each."

Where reasonably efficient and dignified installations of the so-called decorative lighting have been put in by private enterprises it is only a question of time when they must be taken over by the city. The benefits of such lighting are just as widely distributed among all classes of citizens as are those of public parks, and there is no logical or business reason why the private citizen should continue their maintenance indefinitely. The fact is that the installations that have been put in by private enterprises show a highly commendable public spirit on the part of those subscribing to them and should be considered object lessons in civic pride, and those who are responsible for them relieved of the financial burden of their maintenance as soon as their utility has been demonstrated.

ARE OUR COUNTRY ROADS TO BECOME "WHITE WAYS"?

One by one the great inventions and discoveries in science have brought mankind into closer relationship and destroyed the isolation of the country. The steam railway marked the beginning of the first epoch of this distinctly modern influence in civilization; and the telegraph, and still more decisively the telephone, have marked long strides in the same direction. The latest of these epoch-making inventions is the automobile, which is destined to play as important a part in the regeneration of rural life as any of the other influences. The most immediate, and one of the most important services which the automobile will bring about is the general improvement of country roads. Generally speaking, we are yet mere pioneers and savages in respect to our public highways outside of the cities.

Better roads inevitably suggest the extended use of public lighting; and so one improvement leads to another until every individual and every phase of life is touched at some point by the beneficient results of scientific progress.

We have heard not a little of the prosperity of the Kansas farmer, and surely evidences are not wanting. The prosperity of the "country town" is an exact measure of the prosperity of the farmer. We have had occasion to remark on the enterprise shown by various small Western towns in the way of public lighting. The scheme reported in the Leavenworth (Kan.) *Times,* if consummated, will break the record thus far, according to the best of our information, in demonstrating the enterprise and ambition of the country town and suggesting possibilities for the development of electric

lighting. The report is worth a careful reading:

"The scheme is this: Herington, a progressive and live city of 5000 people in Dickinson County, recently built a big and complete municipal electric lighting plant. As Herington is growing like a weed and the city is spreading out its city limits and filling its lots with beautiful homes, the officials decided that an electric lighting system large enough to supply a city of 25,000 people should be built. Then they installed machinery not equaled by any of the towns in Kansas.

"Not long ago Hope, a town 9 miles west of Herington, brought up the electric lighting proposition. Hope is a growing town of 900 people, and the electric lighting facilities have been poor.

"While the matter of constructing a municipal plant was discussed by the people and by the City Council some one suggested that Herington be asked to supply Hope with 'juice' from their municipal institution.

"The thought was heralded with glee by the people and a delegation was sent to Herington at once. An agreement was made and actual work on the big line between the two cities has commenced.

"Herington will supply Hope with electricity at the same price that is charged to its own citizens. But the people of Hope have the expense of building and maintaining the pole line between the two towns. This is a distinct advantage to Hope—they receive a twenty-four-hour current and it costs the city nothing but a few thousand dollars for the electric line.

"The people of Hope are not the only ones to realize the advantages.

"The large number of farmers living on the direct highway between the two cities have decided to enter the game. Electric lighted barns, houses, chicken coops, dog kennels and beehives will be the line of prosperity between Herington and Hope shortly. Every farmer has signified his willingness to tap the electric line.

"The 9 miles between the towns are of the best roads in Central Kansas—and the prettiest scenery. A scheme is on foot at this time to light the entire highway with incandescent lights, making a boulevard of 9 miles—smooth and electric lighted."

Kansas, however, is not the only "voice crying in the wilderness" for light, as the following extracts from an article in the Dayton, Ohio, *News* plainly indicates:

"Some time ago an ingenious theory was adopted as possible to put into practice of covering an entire county, along its principal roads, with a system of electrically lighted signs, showing cross roads, their ultimate destination—in fact, everything necessary to show the belated traveler where he was 'at' in every sense of the monosyllable. In one of the leading automobile publications the matter was illustrated how cross road signs should be so placed that by turning the head lamps of the machine upon the sign by use of the steering wheel the operator might be able to get his location and determine the direction he deemed necessary to take to reach his home. Now the only practical way to determine this question is by the use of electric signs. That this solution of the vexing problem is fast coming into vogue is shown by an article in a recent issue of the Indianapolis *Star*, wherein it was said that a meeting was to be held by suburban residents to enforce upon the municipal authorities and the county commissioners the absolute necessity of extending electric light wires to the country districts along the improved roads so that this exigency of modern times might be met in the most practical manner. There is no use of further discussion of this issue. The growing use of the automobile by both city and country residents has solved the necessities of the case for all time to come. The only question remaining open for solution is that relating to the best means to carry it out. For instance, how shall the cost of the extensions be met? Well, not so long ago the Board of County Commissioners granted to the Dayton Electric Lighting Company a permit to extend its lines out the Eaton pike to the Infirmary road and along that thoroughfare to the county infirmary, a line to be used under the terms of a special contract for furnishing light, heat and power to that institution. At the same time the resolution of the board contained a provision whereby the company might give to residents along the line of the extension facilities for lighting their homes, for using electric power for running house or farm machinery and what not. So the Dayton Electric Lighting Company was enabled to make its first excursion into country territory within its history as a purely municipal concern. The county benefited by securing a cheaper lighting and power system and the company benefited by an extension of its lines into an untried field. No complaint has ever been heard from the party of either part that the experiment was unsatisfactory, and why should not the effort be extended to cover a wider area? Now, then, for the gist of the whole matter as indicated in the Indiana publication. It runs as follows:

"'With both the Merchants' Heat & Light Company and the Indianapolis Light & Heat Company applying for electric light franchise in Southport, and offering farmers between Indianapolis and Southport electric current, and with the Indianapolis company pushing an extension toward Cumberland, the farmers of Marion County believe it will be a comparatively short time before electricity is as common a thing on Marion County farms as the telephone has come to be.'"

IS CHICAGO TO BECOME THE BEST LIGHTED CITY IN AMERICA?

The sewers of Paris have furnished an enticing subject for writers fond of curd-

ling the blood of their readers with gruesome tales, as the many admirers of the immortal Jean Valjean will recall. The great sewer of Chicago affords a theme for the construction of a modern romance of science that only needs the genius of a Hugo to give it undying fame. Instead of furnishing an incentive to crime and a hiding place for the criminal and his ghastly work, the Chicago sewer is to supply the means wherewith to light the city so brilliantly as to make acts of violence almost impossible. The power generated by its drainage canal, as the great sewer is called, is converted into electricity and is to be utilized by the city for public lighting. What this will accomplish may be conceived by the following items from the *Record-Herald:*

"Chicago is to become as brilliantly lighted a metropolis as any of the gay capitals of Europe, and the great sewer—the drainage canal—is to furnish the illumination.

"At every street corner in the city an arc light is to be installed, lamps are to be placed in all the umbrageous places, all parts of the city will burst into effulgence at nightfall and crime will lose the shadows in which it hides. What it means to the police may be seen in the sage remark once made by Carter H. Harrison the elder that 'one street lamp is as good as ten policemen.'

"Ten thousand new arc lamps are to be added to the city's lighting equipment. Every street intersection is to have a light.

"Five thousand of the 12,200 now in service are to be replaced."

Not the least interesting result of this liberal use of electric light is the illumination proposed for the City and County Building. The *Post* says:

"City officials plan to make the new building the brightest spot in town at night. The contract with the sanitary district for providing the city with street lights practically is closed and arrangements for the city hall square illumination will be completed soon.

"Three different methods suggested are:

"Ornamental iron posts, topped by clusters of five lamps, to be set along the outer edge of the sidewalks.

"Flaming art lights suspended by brackets from a ledge at the bottom of the pillars and 60 ft. above the sidewalk.

"Arc lights suspended from the ledge at the top of the building.

"If the lights are set on the sidewalk, it is planned to have 61 standards, which will be placed 30 ft. apart around the big building. The proposed standards are 14 ft. in height. Two hundred candle-power tungsten lamps will be used. One lamp will top each and four lights will surround it on brackets.

"The architects favor suspending the lights from the building, owing to the varying width of the sidewalks. Illumination which will throw a strong and even light on the sidewalk is proposed. Lights near the top of the building, it is believed, would not be satisfactory."

WASHINGTON, D. C., STILL EXPERIMENTING ON STREET LIGHTING

"Planning to substitute high-power incandescent street lights for arc lamps, Electrical Engineer Walter C. Allen will begin a series of experiments Monday night with various types of new style street lamps. The experiments will be conducted on the section of Pennsylvania avenue from Fifteenth street westward to Seventeenth street, in the space in front of the White House and the Treasury and State, War and Navy departments, and if it is found that this wide street can be successfully illuminated by the use of incandescent lamps the electrical department will at once adopt them."—*Evening Star.*

ANOTHER "BEST LIGHTED CITY"

"At a special meeting of the Lighting Committee of the City Council of East St. Louis yesterday, the members declared they are determined to make that place the best-lighted city of its size in the United States, in both residence and business sections.

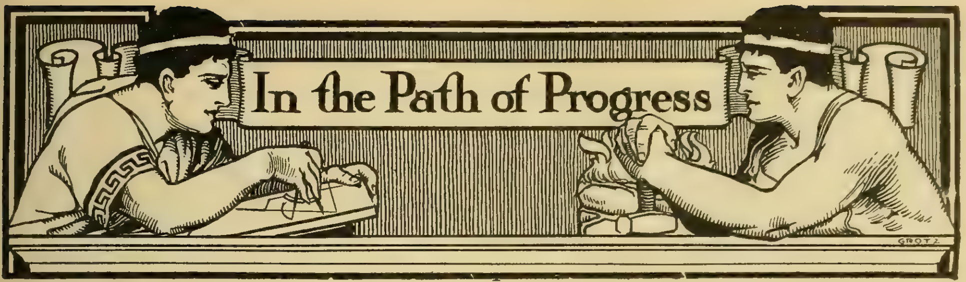
"The committee will recommend to the Council next Monday that 14 new arc lights be established in the residence part of the city immediately.

"Although it was not possible to take official action regarding the establishing of the 'cluster' lights on Collinsville avenue, Missouri avenue, Broadway and other business streets, because the committee did not have the necessary cost figures at their command, it was unanimously voted to put in several hundred of the 'cluster' lights in the business part of the city if they can be erected and maintained at a reasonable cost."—*St. Louis Republic.*

YONKERS HAS TWO "WHITE WAYS" AND WANTS MORE

"While enterprising business men are going down into their pockets to improve the illumination of important city thoroughfares the Hub of the town is a rather dark place at night.

"Lower Main street for one block has been made light by night through the initiative of the wide-awake storekeepers. Now New Main street men have just contracted for more light, while Riverdale avenue storekeepers have been seriously considering similar action. Undoubtedly other sections will follow."—*Herald.*



The "On the Level" Street Lighting Fixture

The Elmer P. Morris Company, New York, have recently brought out a central suspension street lighting fixture of novel design. This is known as the "On

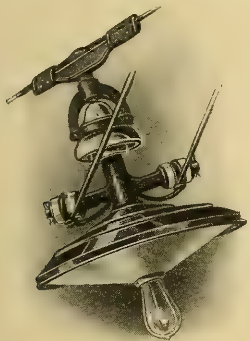


FIG. 1.

the Level" Street Lighting Fixture, and it is so constructed that the reflector will always remain on the level, as its name implies.

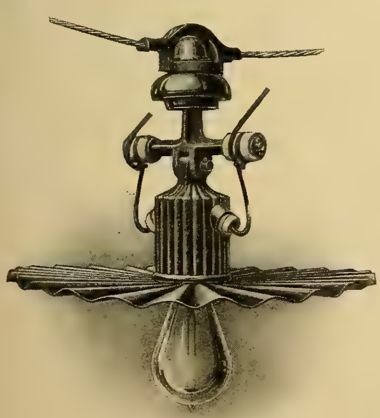


FIG. 2.

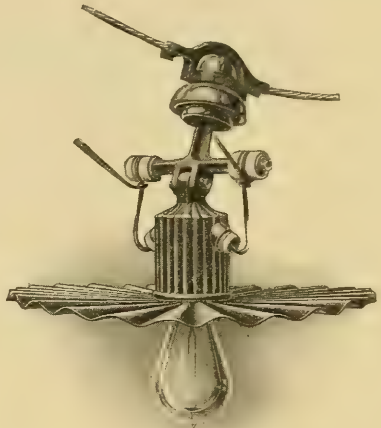


FIG. 3.

With the improvements which have been made in recent years in both lamps and reflectors, it becomes more and more important to obtain the desired results with these devices and undoubtedly one of the most important is that the reflector remains in a horizontal position.

When using the ordinary type of reflector centrally suspended, they are rarely level, owing to the strain of leading-in wires or owing to the fact that suspension wires are not level, as shown in Fig. 1. The "On the Level" Fixture shown in Fig. 2 is designed to overcome this trouble.

The crossarms are placed upon the holder and not upon the reflector. It will be seen from Fig. 3 that even with unusual strain the reflector remains level. The sockets above the reflector are protected by porcelain bushings and no bolts or plugs are necessary to make connection to span wire. The enameled reflector does not come in contact with other metal

parts and troubles from chipping are eliminated.

A 38-Hour Flaming Arc Lamp

The limitation of the burning of an open arc lamp imposed by the use of a single set of carbons was practically overcome by the substitution of the double carbon lamp; and the overcoming of a similar shortcoming in the flaming arc lamp seems to have been successfully accomplished in the same manner. A flaming arc embodying the same principle has been introduced in this country under the name of "The Main Flaming Arc." This lamp uses the escapement feed mechanism, which is the only one which has proved entirely satisfactory under all conditions, and by a simple device automatically throws into service a second pair of carbons when the first have been consumed.

The use of a prismatic inner globe serves to give an exceedingly advantageous distribution for exterior lighting while preventing the collection of dust on the under globe.

The lamp is handled by the Main Electric Company, Marbridge Building, New York.

National Electrical Lamp Association Bulletins

Bulletin No. 13, dated September 1, describes the Mazda Series Lamps and gives all the technical data which the illuminating engineer would need to have in order to make the best use of them in different installations.

Bulletin No. 14, dated September 1, describes the Hylo-Economical turndown lamps, likewise giving technical data and applications for the use of this form of luminant.

Copies of the above can be obtained by addressing the Engineering Department, National Electric Lamp Association, Cleveland, Ohio.

The Sharp-Millar Portable Universal Photometer Up-to-Date

The establishment of illuminating engineering at once created a demand for a portable photometer which should possess a degree of accuracy commensurable with the standard instruments then in use and which should be sufficiently simple and positive in its action to enable a reasonable degree of accuracy to be obtained by the unprofessional user. Many devices appeared upon the market, but unquestionably the most successful up to the present time has been the instrument designed by Messrs. Sharp & Millar of the Electrical Testing Laboratories and manufactured by Foote, Pierson & Co., New York. This instrument met the requirements to such an extent that it at once became recognized as standard.

An article fully describing the apparatus in its latest form will appear in our next issue.

Announcement

Owing to the great increase of business in the vicinity of Atlanta, Ga., and Rochester, N. Y., the H. W. Johns-Manville Company has recently opened a new office in each of these cities.

The Atlanta office is located in the Empire Building, in charge of Mr. W. F. Johns, who has been traveling this territory for the company for a number of years, and the Rochester office is located at 725 Chamber of Commerce, in charge of Mr. H. P. Domine, formerly with the Buffalo branch of the company.

The rights for France and Belgium of the Moore Light have just been acquired by a group of capitalists headed by Otto Markiewicz. The new company bears the title "La Lumiere Moore," and will have its headquarters in Paris, temporarily at Hotel Regina. In connection with these transactions a series of experiments and tests of all the colors on both the tube and window forms of the light was conducted for the foreign capitalists by Professor Wedding of the University of Charlottenburg.

A year ago the "Allgemeine Moore Licht Gesellschaft" was established in Berlin and a little later an auxiliary operating company, the Moore Licht Aktiengesellschaft. Russian, Norwegian and Swedish companies have been organized within the last year and Moore lights are now in use in more than thirty European cities.

PROCEEDINGS

Proceedings of Technical Societies

DISCUSSION

Program of the Fourth Annual Convention of the Illuminating Engineering Society, Baltimore, Oct. 24-25

Convention Program

MONDAY—OCTOBER 24.

Morning.

8.30 a.m.—Registration Bureau opens in McCoy Hall, Johns Hopkins University.

10.00 a.m.—Opening of the convention in McCoy Hall, by the chairman of the Convention Committee, Mr. Van Rensselaer Lansingh.

Address of welcome to the city, by Hon. J. Barry Mahool, Mayor of Baltimore.

Address of welcome to the Johns Hopkins University, by Dr. Ira Remsen, president.

Annual address of the president of the Illuminating Engineering Society, Dr. Edward P. Hyde.

Annual Reports of Committee Chairmen:

Committee on Nomenclature Standards, Dr. Alexander C. Humphreys, chairman.

Sub-Committee on Photometric Units, Dr. Clayton H. Sharp, chairman.

Committee on Division of Membership, E. L. Elliott, chairman.

Afternoon—2.30 o'clock.

"Central Station Illuminating Engineering Department Work and Methods Applied by the Denver Gas and Electric Company," by C. F. Oehlmann.

"The Effect of Light on the Movement of Lower Organisms," by Prof. Samuel O. Mast.

"Illuminating Engineering Sheets for the Calculation and Recording of Data," by J. S. Codman.

"Some neglected Considerations Pertaining to Street Illumination," by Preston S. Millar.

Evening—8 o'clock.

Lecture in McCoy Hall by Van Rensselaer Lansingh, on "Illuminating Engineering." This will be a popular lecture for the benefit of the people of Baltimore, and will be followed by an exhibition in the Physical Laboratory, of the apparatus to be used in the lecture course. The lecture will, of course, be open to all the members of the Society.

TUESDAY—OCTOBER 25.

Morning—10.00 a.m.

"Relations Between Pressure and Light Output with Various Gas Lamps and Burners," by Norman Macbeth.

"Some Spectral Luminosity Curves Obtained by Flicker and Equality of Brightness Photometers," by Dr. Herbert E. Ives.

"The Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light Sources," by J. G. Felton and E. J. Brady.

"Report of Progress on Flame Standards," by E. B. Rosa and E. C. Crittenden.

Afternoon—2.30 o'clock.

"The Value of Illuminating Engineering to the Commercial Man," by W. J. Serrill.

"Practical Value of Illuminating Engineering to the Central Station," by J. F. Gilchrist.

"The Value of Illuminating Engineering to the Manufacturer," by V. R. Lansingh.

4.30 o'clock.

OPENING EXERCISES OF LECTURE COURSE.

PRESIDING OFFICER, DR. IRA REMSEN.

Opening address by Dr. Ira Remsen.

Address by Dr. Edward P. Hyde.

Five-minute addresses by the presidents of American Institute of Electrical Engineers, American Gas Institute, National Electric Light Association, International Acetylene Association, National Commercial Gas Association, Association of Railway Electrical Engineers, American Institute of Architects, Academy of Ophthalmology, American Academy of Oto Laryngology, Ophthalmological Association.

ENTERTAINMENT.

MONDAY—OCTOBER 24.

Automobile ride for the ladies through the suburbs of Baltimore.

Reception, Hotel Belvedere, 9.30 p.m.

TUESDAY—OCTOBER 25.

A trolley trip and luncheon for the ladies. Special cars will leave Howard and Centre streets in the immediate vicinity of the University, at 10.00 a.m. Lunch-

eon will be served at the Baltimore Country Club at 12.30 p.m.

A subscription banquet will be served at the Hotel Belvedere at 8.30 p.m. to both ladies and gentlemen in attendance on the convention.

Toasts will be responded to as follows:

"Baltimore's Hospitality."—Hon. J. Barry Mahool, Mayor of Baltimore.

"The Importance of University Training to An Engineer."—Dr. Ira Remsen, president Johns Hopkins University.

"The Function of the Illuminating Engineering Society."—Dr. Edward P. Hyde, president.

"Illumination on Current Topics."—Hon. Ferdinand C. Latrobe, president Consolidated Gas Electric Light and Power Company of Baltimore.

Tickets for the banquet are to be obtained at the Registration Bureau.

An Unrecognized Aspect of Street Illumination, by Preston H. Millar.

A paper presented at the October 13 meeting of the New York section of the Illuminating Engineering Society.

This is a very brief paper, but one which contains a matter of great importance in the consideration of street illumination. The author sums up his paper as follows:

CONCLUSIONS.

The perception of large objects in the street is accomplished by the aid of light falling upon the objects when they are in the immediate vicinity of a lamp, and elsewhere when for some reason or other there is no bright background against which they may be contrasted. Most frequently, however, they appear silhouetted against a lighted background. As the discernment of large objects is in some cases the most important, and in all cases an important, purpose to be achieved, this is one of the essential elements of the problem of street lighting. Having failed to receive due recognition, it affords a new viewpoint from which to consider the whole subject. The writer hopes at an early date to present before this society supplementary considerations which this point of view adds to discussions of such aspects of the problem, as, light, distribution, uniformity, glare, test criteria, etc.

Mazda Series Street Lighting, by Howard L. Aller; read before the association at its eighth annual convention, held at Glenwood Springs, Colo., September 21, 22, 23, 1910; the Colorado Electric Light, Power and Railway Association.

The object of this paper is to point out some of the advantages of Mazda Series Street Lighting over other systems and to show a few points of interest in some existing Mazda installations.

"As with all great inventions of the past, man has endeavored to check the adoption and the advance of the Mazda lamp, dreading the temporary disturbance which the innovation must give to business. Every such innovation, however, has created new fields for enterprise which more than compensate for the temporary loss. The Mazda lamp for street illumination has created such a new field. There is no reason, whatever, why every central station manager should not materially increase his revenue by pushing the Mazda lamp to stimulate a demand, first, for greater and better illumination throughout the residential section, and, secondly, for decorative illumination in the downtown section. Moreover, the Mazda lamp has been brought into use after the arc lamp and the gas mantle, and is used to replace these older illuminants. Therefore, while the illumination may be greatly increased by the use of the Mazda lamp, the rates per kilowatt hour will not be decreased."

"Should Gas Arcs be Rented or Sold?" by G. W. Thompson; *Progressive Age,* October 15.

A paper presented at the meeting of the American Gas Company's managers. The writer favors the renting method and gives his reasons worked out in great detail.

A Development of Vacuum Tube Lighting, by D. MacFarlan Moore; paper read before the Franklin Institute, Philadelphia, September 21.

In this paper Mr. Moore reviews his work in developing the vacuum tube light, bringing the record of progress down to the present time.

The Use and Abuse of Illumination, by Paul Bauder; *paper read before the Convention of Building Managers, Washington, September* 12.

The paper is largely devoted to an exposition of the advantages of metallic filament lamps for office buildings.

Review of the Technical Press

American Items

New Books

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS; third edition; size, 4 x 6½ in.; 1432 pages and index; illustrated; flexible leather; McGraw Hill Book Company, New York; $4 net.

This is the last edition of a work which has been recognized as a standard since its first publication. The entire subject is covered in 20 different sections, the section on illumination being the only one of direct interest to illuminating engineers. This has been written by Dr. Louis Bell and covers the subject in the thorough, clear and accurate manner characteristic of this authority on the subject.

In the first paragraph Dr. Bell says: "The art of illumination may be defined as the art of using artificial sources of light. In this work the ultimate question is the amount of useful light furnished the eye for the required purposes and fulfilling the necessary requirements with respect to color and steadiness."

The fact that the term "illuminating engineering" does not appear throughout the section seems to indicate that the author still prefers to consider the subject as an art rather than a science, as set forth in his well-known work "The Art of Illumination.' This position is hardly consistent with the thoroughly scientific and mathematical treatment he has given in this instance the subject.

The illuminating engineer will be inclined also to take exception to the second sentence of the introductory paragraph quoted above. The amount of useful light furnished the eye, even if steady and of a desirable color, is by no means the ultimate question in illuminating engineering in the opinion of many of those who consider the subject a scientific or engineering problem. The quality of the light as affecting the organs of vision physiologically is at least of as great importance as mere quantity or intensity of illumination; and so far as the lay user of light is concerned, the "ultimate question" with him is, "By what illumination can he see best?"—a simple question which involves much more than can be expressed in terms of any photometric measurement. In view of the increasing variation in the quality of light from different commercial sources, and the increase in knowledge of the physiological effects of light and the relation of eye-strain to the general health, it behooves the professional illuminating engineer to look well to the physiological side of the problem and not to content himself with merely the physics and mathematics of light.

On the subject of nomenclature Dr. Bell agrees with Professor Hering in stating that the "mean spherical candle-power defines the total flux of light obtainable from the given source." "Mean lower hemispherical candle-power," he says, "is a rating most frequently used merely as an apology for a bad vertical distribution. It can be justifiably applied to incandescent lamps only when the spherical distribution is converted into a hemispherical one by a reflector." The "justifiable" use, which the author admits, is a very extensive one as generally applied. Illuminating engineers have to deal with light-sources and lighting units. The former is a luminous body of some sort in its simplest practical form without the addition

of any accessory to modify the distribution of its rays—like a bare incandescent lamp. A lighting unit is a light-source placed in some sort of an accessory to improve the natural distribution of its rays—such as an incandescent lamp with a reflector. It is quite as important for the engineer to know the result of a lighting unit as of a light-source, and this is best expressed in nearly every instance by mean hemispherical candle-power. In fact, the natural distribution of a light-source is of interest only as giving information from which to design the proper accessory for redistributing the light. Dr. Bell uses the term "Illuminometer" to include instruments used "for the mere purpose of comparing illumination," the instruments included in this class being those depending upon visual acuity.

Although the section contains but 47 pages and is liberally illustrated with charts and diagrams, there is not an important phase of the subject which is not touched upon and in a masterly manner. While much detail could not be expected, the mistake has not been made of condensing beyond the point of clearness. It is perfectly safe to say that in no other like space can so much valuable and authoritative information on the subject be obtained, and the reader who will make himself thoroughly familiar with the text given will have a good working knowledge of the elements of illuminating engineering.

EDITORIALS.

Street Lighting Economy; *Electrical World*, September 29.

Illuminating Engineering Convention and Lectures; *Electrical World*, October 6.

Photographic Photometry; *Electrical World*, October 6.

The Light of the Fire-Fly; *Electrical World*, October 13.

Economy in Switch-Board Lighting; *Electrical Review and Western Electrician*, October 1.

Train Lighting; *Electrical Review and Western Electrician*, October 15.

The Arc Light; *Journal of Electricity, Power and Gas*, October 1.

Illumination of a New York Department Store; *Electrical World*, September 29.

An illustrated article giving a general description of the electrical installation of the new Gimbel Bros. Department store in New York City. The same subject is treated elsewhere in this issue.

Direct Comparison, Acuity and Flicker Photometric Methods Compared, by Sidney W. Ashe; *Electrical World*, September 29.

A short article giving the results of tests made to measure the intensity of the 16 c.-p. lamp by the three different methods in order to compare results. The following is a summary of the results obtained:

1. Although every precaution was taken to eliminate all possible errors, physical and physiological, the medians of the three sets of values did not coincide.

2. Between the direct-comparison method and the flicker method there was always a definite difference of from 1 per cent. to 3 per cent.

3. The readings by the flicker method clustered most closely about the median, those of the direct-comparison method were about twice as scattered and those of the acuity method were about five times as scattered.

4. When the flicker photometer alone was used it was much easier to compare lights differing in color than those of the same color, the flicker being more decided where the difference of color was marked. This fact did not harmonize with numerous other statements previously printed to support the belief that the flicker is solely a function of brightness.

5. Where so-called green and blue incandescent lamps were used the values for the flicker photometer clustered even more closely together, those of the direct-comparison method diverged about twice as much as before and those of the actuity method were about the same.

6. In taking the direct-comparison if the observer occasionally removed his eye while making settings the values clustered more closely together. This fact was marked particularly with the colored lights.

7. The medians of different sets of values where colored lights were used with the direct-comparison method seemed to disagree slightly, the observer's concept of the intensity value of different colors seeming to change.

ANIMATED ELECTRIC ADVERTISING SIGN, by S. D. Levings; *Electrical World*, September 29.

An illustrated article describing a new method of producing motion effect in electric signs by moving the lamps themselves, as well as lighting and extinguishing them.

RECENT STUDY OF THE FIRE-FLY, by Herbert E. Ives; *Electrical World*, October 13.

The article gives the results of experiments made to determine the efficiency of the light of the fire-fly. The author concludes that although the evidence of the investigation is of a negative character, it lends probability to the supposition that the visible radiation is the only radiation other than bodily heat.

ARC LAMPS FOR PROJECTION, by Henry Phelps Gage; *Electrical World*, October 13.

An illustrated article giving a very complete treatment of the subject taken from tests made at Cornell University, and in the Illuminating Engineering Laboratories of the General Electric Co.

THE DENVER GAS & ELECTRIC COMPANY'S NEW BUILDING, by H. H. MacPherson; *Electrical Review and Western Electrician*, October 15.

An illustrated article describing in detail the illumination of this building, which is soon to be opened. It probably represents the most elaborate scheme of permanent exterior lighting that has ever been attempted, 10,000 lamps aggregating 60,000 c.-p. being used for the purpose. The entire lighting scheme, both exterior and interior, was designed by Messrs. Williamson & Oehlemann, the illuminating engineers of the company.

MODERN ILLUMINATION, by Newton Harrison; *The Central Station*, October.

A continuation of articles on this subject by the same author. Takes up a large number of subjects which it necessarily treats very briefly.

COLOSSAL INCANDESCENT LAMPS, by Roscoe Scott; *The Central Station*, October.

A short, illustrated article describing the 400 and 500 watt tungsten lamps recently put upon the market.

THINGS TO REMEMBER IN PLANNING THE LIGHTING OF A HOME, by E. B. Rowe; *Selling Electricity*, October.

A short article taking up a number of points regarding the wiring, and the location of switches and lamps in residence practice.

FALLACY OF EYE EXAMINATIONS AS GIVEN RAILROAD EMPLOYEES, by William G. Wolton; *Optical Journal and Review of Optometry*, October 6.

A short technical article of which the following is the conclusion:

"I would like to see it a national law that every one employed in running an engine, or in fact, any vehicle propelled by power should have not only a dynamic examination made of his eyes, but static as well, and if the vision was not normal under the static examination that it be obligatory for him to wear glasses correcting the ametropia. It would be very much better for a man having only one-half of normal vision, but fully corrected, than one who had normal vision, but with the same amount of error hidden by the accommodation."

VISION, by Dr. E. H. Hazen; *Optical Journal and Review*, October 6.

A short installment of the serial articles on this subject. The chapter is entitled "The Development of the Subject." The treatment is strictly technical, and will interest only those who are thoroughly familiar with the physiology of the eye.

SOME ILLUMINATING FEATURES OF THE MILES THEATRE; *Electrocraft*, October.

A short article with numerous illustrations showing principal lighting effects in this new theatre located in Detroit.

ILLUMINATION AS AN INSTRUMENT IN THE EMPLOYER'S HANDS, by Roscoe Scott; *American Industries;* October.

A short article with a large illustration, the purpose of the article being to call attention to the value of good illumination in commercial lighting.

Outdoor Lighting in England, by Norton H. Humphrys; *American Gas Light Journal*, October 17.

A serial contribution, the first installment appearing in the issue of October 10, the second October 17.

The writer gives a fairly comprehensive review of the history of outdoor lighting in England, the last article bringing it up to the introduction of the upright mantle burner.

Boulevard Lighting as a Municipal Booster, by Joseph A. McNeel; *Progressive Age*, October 15.

An illustrated article describing the lighting installation recently put in on one of the boulevards and park entrances in Denver. Nernst and tungsten lamps are used.

Demonstrating the Possibilities of Modern Gas Lighting, by Norman Macbeth; *Progressive Age*, October 15.

An illustrated article discussing the advantage to gas companies of properly showing the effects of gas illumination by utilizing the best practice in illuminating their own showrooms.

Illustrations of recent good installations made in Knoxville, Tenn., Wilming, Del., and Spokane, Wash., accompany the article.

Foreign Items

Compiled by J. S. Dow.

Illumination and Photometry

The Recent "Congrès Internationale des Maladies Professionelles."

The above congress deserves a special note. Its object is to deal with industrial hygiene. The meeting held in Brussels on September 10 was the second, the first being held in 1906 at Milan. It was a very important gathering, receiving direct Government patronage and representation from the chief countries in Europe.

On this occasion a special section was devoted to the eye and factory lighting and the Illuminating Engineering Society in Great Britain nominated four delegates, of whom eventually Mr. L. Gaster and Mr. J. Eck were able to attend. The former read a paper dealing with factory lighting and summarizing the legislation already on record in different countries dealing with the subject. Special stress was laid on two points (1), the need for a minimum illumination in the neighborhood of dangerous machinery, and (2) the need for recommendations as to the placing of lights so as to avoid glare. Other papers were read by Dr. A. Broca, Mons. F. Massarelli, Dr. F. Terrien, all of whom were concerned with illumination. Dr. Broca discussed the physiology of the eye in great detail, pointing out the connection between visual acuity and good illumination. He took the view that the generally suggested minimum illumination of 10 lux was too low. He thought 30 to 40 lux (3 to 4 ft. candles) were needed. The other two authorities referred to dealt with the practical aspects of the subject, M. Massarelli in particular laying stress on the want of more definite rules for the guidance of inspectors employed by insurance companies, etc.

There were also a number of other special papers dealing with such questions, as the eyesight of workers in textile factories, the tendency to cataract in glass works where operators are exposed to the glare of the furnace, etc.

The important place assigned to illumination at this congress is regarded as of a very important precedent and there can be no question that it will be beneficial in leading to a study of the subject of factory lighting in many influential quarters.

The Eye as it Affects Practical Illumination, by J. Darch (paper presented at the Congress of the Royal Sanitary Institute, September

5, *J. G. L.*, September 20; *G. W.*, September 17).

This paper also serves to illustrate the importance now attached to illumination by bodies dealing with sanitary science. Mr. Darch lays stress mainly on the need for methods of shading which shall screen the eye from the direct rays of light and yet absorb a minimum of light. He recommends that landings, porches. etc., should be illuminated as far as possible by making use of reflection for light-tinted surfaces rather than by exposed lights. The generally accepted limit to intrinsic brilliancy on the part of lamps in interiors, 2½ c.-p. per square inch, he thinks too high and would prefer not to exceed 0.05 c.-p. per square inch if possible. He regards stage illumination in theatres as one of the best examples of good lighting, inconvenient bright sources between the eye and the stage being always avoided; this model should be followed in shops which at present are rarely illuminated in the true sense—only "invested with obtrusive lights which advertise themselves rather than the goods."

COMPARATIVE LIFE TESTS ON GLOW LAMPS, by C. C. Paterson and H. Rayner (*Electrician*, August 26).

An account of tests carried out jointly at the National Physical Laboratory and the Bureau of Standards, with a view to testing the consistency of experimental methods. The results are very satisfactory and suggests that a very fair idea can be secured as to the probable life of lamps of the same class by the "short" overrunning test.

ILLUMINATION, ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter (*Illum. Eng.*, Lond., continued).

The author concludes the section of his article dealing with measurements of illumination in streets, theaters, etc. He next proceeds to discuss "Errors in Photometry," which he subdivides into several classes, such as those due to mistakes on the part of the operator, those due to inaccuracy on the apparatus, etc.; he also enters into the theory of the calculation of the probable mean error in a single reading.

THE BOX INTEGRATING PHOTOMETER, by L. Wild (*Illum. Eng.*, Lond., September).

Dr. Sumpner has proposed the use of a square box, whitened inside, as a means of obtaining the M. Sph. C.-P. of glow lamps, instead of the usual sphere. The author now describes a series of tests, involving altering the position of lamps inside the box, etc., to test the accuracy of the arrangement. He finds the resultant error fell within 3 per cent. and regards the box as sufficiently accurate for practical purposes.

AUTOMATISCHE FEUERZEUGE UND ZUNDER (*Z. f. B.*, Sepetmber 10).

Describes several simple forms of kindling devices used in Germany for pocket matchboxes, lighting gas flames, etc., based on pyphoric rubbing contacts using the metal cerite.

HALTBARKEITSPRUFUNGEN IN DER BELEUCHTUNGSKORPERINDUSTRIE, by H. Pudor (*Z. f. B.*, September 20).

MODERN LIGHTING, by C. Toone (*Elec. Review*, September 9).

A MUSEUM DEVOTED TO ILLUMINATION (*Illum. Eng.*, Lond., September).

STREET LIGHTING IN WESTMINSTER (*Electrician*, August 26).

FACTORY LIGHTING, by G. B. Barham (*Electricity*, August 12).

ELECTRIC LIGHTING.

JOINTS IN METALLIC FILAMENT LAMPS, by G. B. Barham (*Elec. Times*, September 1).

A NEW FORM OF TUNGSTEN LAMP, by C. F. Scott (*Electrician*, August 26).

TUNGSTEN LAMPS FOR STREET LIGHTING (*Elec. Engineer*, September 2).

THE USE OF METALLIC FILAMENT LAMPS FOR STREET LIGHTING (*Electrician*, September 23).

The first of these two articles contains a series of comments from central station engineers in different parts of the country and others on the question of the effect of metallic filament lamps.

Die "Wotan" Lampe (*Z. f. B.*, September 10).

Describes the new lamp utilizing drawn tungsten. The name is stated to be derived from the two words "wolfram" and "tantalum," the idea being that filaments so made combine the efficiency of tungsten filaments with the durability of tantalum ones.

La Lumière Moore (*Rev. des Eclairages*, September 15).

An illustrated description of the Moore system with some particulars of a Paris installation.

The Quartzlite Lamp (*Elec. Times*, September 15).

A description of the newly introduced "Quartzlite" lamp, which is a mercury lamp with a small quartz glass tube; a specific consumption of only 0.25 watts per candle-power is claimed, and the tubes are stated to last over 1000 hours. A lamp of the same kind and with similar claims is the "Silica" lamp, introduced by the Westinghouse Company.

Arc Lamps (*Electrician Industrial Supplement*, September 23).

Neuere Bogenlampen (*Z. f. B.*, August 30, September 10).

Gas, Oil, Acetylene Lighting, Etc.

The Influence of Hot Surfaces upon Combustion, by Prof. W. A. Bone (*G. W.*, September 10; *J. G. L.*, September 6).

Neuer Elektrische Gasfernzunder, by Wendt (*J. f. G.*, September 17).

Gasdruckfernzundung, discussion (*J. f. G.*, September 17).

Automatic Gas Lighting by Pellets (*G. W.*, August 27).

The above three articles deal with the question of automatic distance gas control. A discussion is proceeding in the *Journal für Gasbeleuchtung* as to the conditions under which methods based on temporary pressure rises can really be made successful; very divergent views are expressed on this point. The last named article is an abstract of Grix's system (see previous review), utilizing pellets of material which become incandescent in a stream of gas and are then automatically withdrawn from the flame as the pellet gets hot.

Bamag Distance Pressure Lighters (*J. G. L.*, September 13).

Colonia Lamp-Masts and Couplings (*G. W.*, August 27).

High vs. Low Pressure Distribution (*J. G. L.*, September 13).

Bridge Lighting by Incandescent Gas (*J. G. L.*, September 13).

An Original Acetylene Inverted Burner (*Acetylene*, August).

The last article contains an account of an inverted incandescent burner, due to Günther and Schimkeek, of Vienna, for which great things are claimed; the specific consumption is said to be as low as 0.2 litres per hour per candle (*i. e.*, about 140 c.-p. per cubic foot of gas per hour). This is very much better than is claimed under the most favorable circumstances even for high pressure gas lighting, but it is not stated whether mean spherical candle-power is intended.

The Standardization of Gas Supply (*Illum. Eng.*, Lond., September).

A general article tracing the progress of legislation on gas testing and showing the steps leading up to the recent bill for a single standard burner in Great Britain.

Notes on Some Early Gas Companies (*Illum. Eng.*, Lond., September).

Contains an account of two very early gas companies formed at the beginning of the last century before meters had come into general use. A reproduction of the original conditions of supply offered to customers is reproduced.

Fortschritte der Spiritusbeleuchtung (*J. f. G.*, September 17).

Les Phares d'Automobiles à l'Acetylene (*Rev. des Eclairages*, August 30).

Contractions used:
G. W. Gas World.
Illum. Eng. Lond. Illuminating Engineer (London).
J. G. L. Journal of Gaslighting.
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
Z. f. B. Zeitschrift für Beleuchtungswesen.

The

Illuminating Engineer

Vol. V DECEMBER, 1910 No. 10

EFFICIENCY

Efficiency, in its broadest sense, is the reciprocal of waste. To accomplish a given result with the least waste of time, material, power, physical energy and nerve force is to attain the highest efficiency.

Waste is a sin that has no redeeming features; its effects are wholly destructive. It is the one factor which enters into every human calculation and diminishes the final product. It is responsible for ninety-nine per cent. of the "high cost of living," which is so troubling high livers at the present time, and the major portion of all poverty and want.

It is reliably estimated that the railroads of this country waste a million dollars a day in operating expenses, and careful calculations of the waste in artificial light place it at twenty-five million dollars annually.

Enormous as is the sum representing the direct waste in light, it covers but an insignificant fraction of the indirect waste of human effort and materials resulting from bad illumination. If the railroads are as inefficient in other respects as they are in their use of light, the figure given is far too low; and they are fully as well managed as the other great industries.

This is the age of "labor-saving" machinery," but the greatest of all machines is still the human machine, and the first condition for its efficient operation is good light. All other economies combined will not offset loss of efficiency in the human machine, for upon it the final results of all other machinery depends. To reduce this efficiency by a failure to supply the best possible illumination is the most inexcusable, the most stupid, the most reprehensible of all commercial blunders.

Let us have more and better light.

E. L. Elliott.

The Congressional Library

The American Chamber of Horrors in Illumination

By E. Leavenworth Elliott.

At the present time the building which houses the Library of Congress in Washington is beyond question the most magnificent library building in the world. The only other library building which will bear comparison is the New York Public Library, now very near completion, and which, when open, may question honors with the national building.

The Library of Congress in itself is one of the world's greatest repositories of literature, and the collection of rare prints, manuscripts and early editions is valuable beyond compute.

This library is the great free library of the nation; any person whatever has full access to its treasures of learning at any time of the day, between nine a.m. and eleven p.m. Unfortunately, it is available only to those who live in the Capital City, or who are able to visit there on occasion.

Architecturally the building stands as one of the masterpieces of American architectural genius. Particularly is this true with the interior. The main entrance hall, or foyer, is one of the finest examples of interior architecture in the world, the stairway in particular being especially magnificent. The construction is of polished white marble, with splendid bronze figures supported on the newels on either side. The mural paintings are by the most celebrated artists, and every effort has been made to render the building a worthy monument to American architecture.

Perhaps even more remarkable than its architectural beauty is the fact that the building was constructed by the Government not only without exceeding the original appropriation but so far within the limit that a snug sum was refunded to the Treasury on its completion. It was built, as the great Panama Canal is now being built, directly by the War Department. If the code of ethics which is comprised in the simple formula, " conduct becoming an officer and a gentleman," sufficies to carry out such projects without even a suspicion of graft, the outcry against the military spirit must lose a large amount of its force. By way of comparison it is interesting to observe that this really fine piece of architectural and decorative art of such magnificent proportions was built at slightly less expense that the comparatively insignificant Hall of Records in New York City. The old nationalism is not so bad after all.

BAD LIGHTING MADE WORSE.

It is only when we come face to face with the artificial illumination of this notable building that we find ourselves in utter despair. On this point apparently, architect, engineer, decorator and whoever else is responsible for the laying out of the lighting became hopelessly lost in their efforts to solve this highly important problem. The original plans were made some years before illuminating engineering was heard of, and when artificial lighting of any kind was tacitly admitted to be a sort of necessary evil, the best that could be done being to choose the least of the possible evils. Unfortunately, this simple purpose often resulted in achieving the most conspicuous of the evils instead. Were a single installation to be sought out as a " horrible example " by which to illustrate the atrocities possible with modern illuminants, the Congressional Library Building must unquestionably be taken as first choice. Scientifically, the electric lamp has been much improved since this building was erected, but most unfortunately the attempt to utilize these improvements in this case have enormously increased the defects. The building was badly enough lighted to begin with, but it is infinitely worse now. Most unfortunate of all is the fact that any adequate improvement in the present lighting methods would require expensive alterations and a considerable defacement of the magnificent decorations.

A library serves two purposes: as a

FIG. 1.—THE READING ROOM.

storehouse for books and a place in which the public may use them. Were it a storehouse only, its lighting would be of little consequence; but a book is of value to precisely the extent that it is used, and the same holds true of a library building. It is well that such buildings be of expressive and impressive architecture as befitting the very essence of civilization which they contain—the knowledge of all the preceding ages. But though they contain the recorded knowledge of all times and body forth immortal genius in their architecture, unless they afford adequate facilities for the dissemination of the horded knowledge, they are mere piles of material and literary junk.

THE MAIN READING ROOM.

To spend an evening reading in the general reading room of the Congressional Library is, optically speaking, to take one's life in his hands. It would be difficult to imagine any lighting conditions which would be more destructive to comfortable vision than those provided in this magnificent room. The room itself is an octagon extending the entire height of the building and surmounted by a magnificent dome. At one of the sides is the main entrance, while the entrances to the book stacks and to special reading rooms open from the other sides. The card catalogues are in the center and the reading tables

arranged in concentric circles about them. Unfortunately, the camera is incapable of taking in at a single view the entire height of this room, so that only the lower portion is shown in Fig. 1. The dome springs from a line somewhat above the main arches. Furthermore, the photograph cannot even give a suggestion of the blinding glare that encounters the eyes in every direction. In the first place, there are lamps on the reading tables themselves. These are three-light standards fitted with 16 c.-p. carbon lamps and fancy etched "shades"; so that immediately in front of the eyes of the reader there are these brilliant light-sources, while all the other table lamps that happen to be lighted are likewise in the direct field of vision.

The general illumination of the room is produced by three different series of lamps. The first series consists of star-shaped fixtures placed in the center of the arches of the first gallery. The second is a row of lamps along the cornice under the main arches. Both of these systems show in the illustration, Fig. 1. The third consists of a row of bare lamps encircling the base of the dome, and does not show in the illustration. In addition to these main installations there are bare lamps lighting the reading rooms on the sides of the rotunda.

FIG. 2.—THE ENTRANCE.

FIG. 3.—ROOM FOR EXHIBITION OF OLD PRINTS.

THE REQUIREMENTS FOR GOOD LIGHTING.

The generally accepted requirements for the illumination of a reading room of this sort are as follows:

1. Individual table lamps provided with opaque reflectors that entirely shield the lamp filament from the eye; if possible, a lamp for each reader placed at the upper left-hand corner of the reader's space at the table.

2. A very mild, general illumination throughout the room.

3. No brilliant light from directly overhead.

4. No bare or dazzling lights in view at any point.

This reading room transgresses every one of these principles, and to a most exaggerated degree. The table lamps are not shaded; the general illumination of the room is brilliant beyond endurance; there are hundreds of dazzling lamps almost directly overhead and thousands of unshaded lamps facing the reader in whatever direction he may turn. The case was bad enough in the beginning when only the comparatively mild carbon filament lamp was available; but the substitution of the new metal filament lamps, with their enormous increase in candle-power and still greater increase in brilliancy, has converted the whole room into what may be styled, without in the least resorting to hyperbole, as a veritable "Chamber of Horrors" in illumination. It is impossible that any one should spend one or more hours an evening in this room without seriously menacing the eyesight and incurring the train of disorders that arise from this sort of nerve strain.

RELATION OF ILLUMINATION TO ARCHITECTURE.

From the architectural or decorative standpoint the illumination reminds one of nothing so much as the gaudiest of entrances to a nickel theatre. That this room, which should be the "first public reading room of the land," and which,

with respect to the value of the library and the magnificence of the architecture, is so beyond question, should be so mutilated and distorted by this atrocious abuse of illumination is an outrage which cries out for abatement.

HOW THE LIGHTING MIGHT BE IMPROVED.

Although there is no logical reason for such a demand, the critic is, nevertheless, frequently called upon to suggest better forms for the things he criticises: " If the lighting here is as bad as represented, tell us how it can be made better," will be a most natural demand on the part of the reader. Fortunately, in this room the conditions are such that very satisfactory reforms are possible without any radical changes in electrical construction or decorative and architectural features. In the first place, it would be a simple and inexpensive matter to divide the reading tables into separate stalls or compartments by placing partitions across the tables of the same height as the front boards, and to provide each of these compartments with a lamp, preferably on a swinging arm, equipped with an opaque diffusing reflector. By this arrangement every reader would be provided with light from the upper left-hand corner, which is the correct direction for reading or writing, with the book or paper on the table. If the reader desired to turn sidewise to the table so as to lean backwards to read, which is a far better position than leaning over the table, the light would still be in the right position.

Second: The star-shaped clusters of lamps in the arches of the first gallery can readily be removed and the arches provided with semi-circular windows of translucent glass, behind which half the present number of lamps can be placed. The galleries serve chiefly as book stacks, and the quality of the illumination is not so important. The fitting of the arches with these windows would add to the decorative features of the room rather than detract, and by properly selecting the glass

FIG. 4.—THE PERIODICAL READING ROOM.

an almost ideal general illumination of the room could be produced.

Third: The rows of bare lamps along the base of the main arches above can be covered with a molding of some of the new forms of translucent glass, which so closely resemble marble as to be indistinguishable at this height. The candlepower of the lamps should be cut down to a half of what it is at present.

Fourth: The row of lamps around the base of the dome can be treated in the same general manner as those just mentioned.

Fifth: The lamps in the reference rooms on the side of the main reading room should be provided with large and rather dense translucent globes.

THE MAIN ENTRANCE.

A view of the main entrance to the building is shown in Fig. 2. The construction here is symmetrical, there being a similar staircase at the right as you enter, a portion of the balustrade of which is shown in the engraving. Each newel is surmounted by a bronze figure upholding a torch. The photograph gives no conception of the visual effect of the illumination. The photographer has gauged his exposure according to the intensity, and has thus succeeded in bringing out the details without the effect of glare. But the eye can make no such regulation; its exposure, so long as it is in the room, is constant, and the general effect of glare directly from the light-sources themselves, which are bare lamps, and from their reflections in the surface of the highly polished marble, is simply intolerable. The torches were made to receive six electric lamps, and in these sockets are now placed high-power tungsten lamps. Not only is the glare thus produced blinding, but the bronze figures, which are really exquisite pieces of statuary, are shapeless masses of black shadows.

THE SECOND FLOOR.

The second floor gallery is utilized as an exhibition room of rare books. The illumination is by clusters of bare lamps placed over the lintels of the doors at each side. Not only is the glare of the lamps themselves objectionable, but the reflection in the glass doors of the book cases is such as to make it exceedingly difficult to examine the books. Improvement of the conditions here is a far more difficult matter than in the main reading room. The new forms of translucent glass could be made to serve a useful purpose, and modern arrangements for show case lighting would remedy the defects in the illumination of the exhibits.

Fig. 3 is a view in one of the rooms on the second floor used for the exhibition of specimens of the engraver's art. The illumination here is by a row of thickly studded electric lamps in an upright position on top of the cornice at the base of the vaulting. It is a case of merciless, painful glare which so dazzles the eyes that they are unfit for use in studying the beauties of the works of art exhibited. The faults are greatly increased by the direct reflection in the glass of the cases which shows in the illustration. A worse illumination for the purpose of this room could scarcely have been devised.

THE NEWSPAPER READING ROOM.

Fig. 4 is a view in the public periodical reading room. The use of this room for this purpose, it seems, was an afterthought, and consequently the illumination was not designed with reference to the purpose. It is a little difficult to imagine what purpose would be well served by such an illumination, but certainly newspaper reading is not among the number. While the lamps have been shaded with opaque reflectors so that those in the farther end of the room are cut off from direct vision, there is still an enormous number of these bright points overhead, which could have no other effect than to confuse and dazzle the eyes. The faults here could be easily remedied. A semi-indirect illumination from the white ceiling could easily be provided which would give a mild intensity throughout the room, and lamps on the racks with opaque shades would furnish the best possible light for reading, whether the reader were standing or sitting.

This review of the illumination of the building does not include the book stacks or any of the private or lesser rooms. It is natural to presume that the illumination in these cases is proportionally faulty. In a conversation with the then superintendent of the building some

years ago the writer ventured to suggest that the illumination, at least in the periodical reading room, could be improved; at that time the lamps were not provided with any kind of shade or reflector. He replied in words to this effect: "Yes, very likely it could; I have had others here with schemes for improving the light, but the public is making no kicks, and why should we go to trouble and expense to change things around?" Is it not time that a "kick" of sufficient vigor be made from some public source to cause an amelioration of the outrages perpetrated in this building, which should be a source of national pride?

Another Example of Western Enterprise in Public Lighting

From time to time we have given examples of the progressiveness and public spirit, for which the West has long been credited, in the way of decorative street lighting systems. In the honor list of towns of this class must be placed the city of Rochelle, Ill., a town credited with a population of about 2500.

A day view in one of its principal streets is shown in Fig. 1. Let those who have been accustomed to think "the East" the only habitable portion of the globe look well at this attractive view. To be sure, there are not as many people and vehicles on the streets as on lower Fifth avenue, New York, in the afternoon, but their absence in Rochelle is quite as creditable to the town as the crowd on Fifth avenue is creditable to the metropolis; it simply shows that the majority of citizens have business to attend to, and are attending to it—and this is as it should be. The width of the street, its smooth pavement, the trim buildings, the shade trees, and, by no means least, the neat, modern lamp posts are all evidences of that most important of all civic virtues—thrift.

A night scene on the same street is shown in Fig. 2; and here, barring the

FIG. 1.—WASHINGTON STREET, ROCHELLE, ILL., SHOWING EFFECT OF ORNAMENTAL STREET FIXTURES. DAY VIEW.

FIG. 2.—SAME STREET, SHOWING EFFECT OF NEW DECORATIVE STREET LIGHTING.

height of the buildings, a stranger might well imagine himself in a city of hundreds of thousands instead of thousands. This installation covers 15 blocks, each block being 330 feet in length. There is a standard at each corner of intersecting streets and three standards between. As shown, each post supports three lamps, which are 60-watt tungstens. Note especially that there is no overhead wiring. There are plenty of Eastern towns anywhere up to ten times the size of Rochelle that cannot show a single modern lamp post, let alone a complete installation.

There is no doubt that they think and act quicker, especially in regard to public improvements, in the West than in the East; and while the Eastern cities and towns are growing fast enough, they may well learn some useful lessons in real progressiveness from Western examples.

The fact is well worth mentioning that Rochelle has a municipal lighting plant, so that it affords at least one case that disproves the contention sometimes made that municipal ownership is opposed to the highest state of progressiveness in public lighting. The Mayor of the city, Mr. W. B. McHenry, cannot escape a large share of credit for this example of true civic pride. May his type increase.

An Unusual Problem in Store Lighting

By J. C. Young.

The most unusual feature in the present problem was the very low height of the ceiling of the room to be illuminated, which was the basement of the Peoples' Department Store of Cedar Rapids, Iowa. The room is 86 ft. long by 40 ft. wide, with the ceiling 7 ft. 6 in. high at its highest point; the ceiling being formed of stamped sheet steel nailed to the joists. As there is scarcely a foot of clear way between the ceiling and the heads of customers, the placing of the light sources required the utmost economy in a vertical space.

To meet this condition, openings 1 ft. square were cut through the ceiling

FIG. I.—DAYLIGHT BASEMENT. PEOPLES' DEPARTMENT STORE, CEDAR RAPIDS, IOWA.

plates and enclosed with boxes; the openings being spaced 10 ft. between centers each way. This gave an additional 9 in. of space for suspending the lights.

As it was desired to use tungsten lamps, and as the regular high-voltage lamp would be likely to suffer from the vibration from the floor above to which the fixture was directly attached, it was decided to use a low voltage series lamps instead. Fifty-watt 28-volt lamps were consequently installed running four in series, each equipped with the standard prismatic globe, which drops below the level of the ceiling as shown.

The resulting illumination is so satisfactory that the proprietor of the store is using it in his advertising, referring to the room as the "Daylight Basement." The installation was designed by the Illuminating Engineering Department of the local central station.

Light Precedes Trade

The slogan "Trade follows light" has been effectively used, to the advantage of both buyer and seller, as a truth easy of verification and impossible of successful contradiction. That the converse of this proposition is equally true, and equally effective as a slogan, appears to have remained for the Edison Electric Illuminating Company of Brooklyn to discover. Scores of decorative and "white way" systems of lighting have been put in throughout the country during the past few years, but, so far as known, they have all been afterthoughts, *i.e.*, have been put up for the purpose of adding to the attractiveness and utility of business

TYPE OF STANDARD ADOPTED.

streets in which all other improvements had already been made. The idea of installing a decorative private street lighting system around a building before it is fairly under way, as an inducement for tenants to come in when the building shall have been finished is certainly a genuine case of "taking time by the forelock."

This is precisely what has been done by a property owner in the business section of Greater New York's second largest borough. The building in question extends an entire block, and consists of a series of ground floor stores with modern apartments above, and is located on one of the principal avenues of the section. At the suggestion of the lighting company the owner has installed an attractive lighting system consisting of six handsome standards, each bearing five 100-watt tungsten lamps inclosed in 16 in. opal globes. The frontage of the block is 200 ft. The illustration on the front cover of this issue is a night view, showing the building in its present state of progress, and the lighting system in operation. So effective has this method of attracting attention proved that the owner has received an increase of 300 per cent. in inquiries from prospective tenants since the installation was put into service and he is now about to install additional standards on the side streets.

But this is not all. The merchants on the opposite side of the street have had a most effective object lesson in the value of enterprise, especially with regard to illumination. The coming event has cast its shadow before, and this shadow falls on the opposite side of the street in a manner that is most painfully impressive to the tradesmen thereon, and they have already taken into active consideration the advisability of putting up a similar, or even more conspicuous installation to dispel this shadow. In the end it will only be a working out in its best sense of the old maxim that "Competition is the life of business," for in this case the competition in lighting will simply increase the total business of the section to everybody's advantage, including the lighting company. The last mentioned has made effective use of this case in its local newspaper advertising.

For some reason not at once apparent, the Public Service Commission permits the local lighting company to make a special advantageous rate for outdoor installations of this kind, so that these standards can be run for less than 4 cents an hour. The lamps are switched on and off by the company on a prearranged schedule.

Indirect Illumination in a Large Auditorium

By G. Harry Swanfeld.

While an auditorium does not necessarily present great difficulties as an illuminating engineering problem, it furnishes a case in which the results are generally either intolerably bad or thoroughly good. In all cases, except lecture rooms for regular use, in which notes are taken, a moderate general illumination must be provided. Perhaps more than in any other case care must be taken in an auditorium to remove light-sources, even those of moderate intrinsic brilliancy, from the direct line of vision. The normal position is with the eye looking slightly upwards, so that any units at ordinary heights shine directly into the eyes.

The auditorium in the present case is in the building of the New Century Club, Philadelphia, and is 38 x 61 ft. in size, with a gallery 15 ft. wide across one end and a stage across the other. The ceiling at the top of the arch is 27½ ft. high and the gallery 12½ ft. above the floor.

In the original installation carbon lamps were inset into the ceiling, with the intention of simulating stars in the sky. A photograph of this arrangement, Fig. 1, shows that the "stars" were simply patches of glare, which proved unbearable to those obliged to sit for any length of time beneath their light.

The case is clearly one that is peculiarly

FIG. 1.—NEW CENTURY CLUB, PHILADELPHIA, SHOWING EFFECT OF OLD DIRECT LIGHTING SYSTEM.

FIG. 2.—SAME ROOM BY NEW INDIRECT LIGHTING.

adapted to indirect illumination. The installation of this system consists of two large indirect lighting units suspended from the ceiling, shown in Fig. 2, and two smaller units under the balcony. The larger fixtures are 42 inches in diameter and each contains 12 100-watt clear bulb tungsten lamps, each equiped with a diffusing mirror reflector. The smaller fixtures are 23 inches in diameter, each containing two 100-watt tungsten lamps similarly equipped. The fixtures themselves are of composition, decorated in a classical design and finished to match the side walls. The ceiling is cream color, the walls light gray and the woodwork Flemish oak.

The total wattage is 2800, giving a specific consumption of 0.975 watt per square foot of floor area. The average illuminations is two foot-candles, which is ample for the purpose. The former installation consumed 4560 watts and gave wholly unsatisfactory results.

The present installation has met with the universal approval of the members, being especially admired when the room is used as a ballroom, the softness and excellent color value of the illumination in this case playing an important part.

The Light of the West

Some of us here in the East think of the West as the place where the sun sets. Though this be true, we must also remember that the time of its setting is much later in that far off region than with us. We might have heretofore attributed this delay to the fact that the sun was loathe to withdraw his face from the land of such stupendous natural beauty; but now we must rather attribute his lingering gaze to jealousy at handing over his prerogatives as ruler of

light to the man-made electric lamp.

We heard in our salad days of youth that "'Tis night brings out the stars"; and so it does, but it much more conspicuously brings out the electric lamp. It is the façade of the skyscraper in these days that is "inlaid with patins of bright gold" instead of the sky. If this seems a mere rhetorical vagary, look for a moment at the picture before you. Is there any constellation that can compare in brilliancy with the spectacle here presented? This, in very truth, is "inlaid with patins of bright gold."

The picture shown is from a night photograph of what is undoubtedly the most elaborate and most beautifully lighted building in the world, both exterior and interior illumination being considered. It is the new home of the Denver Gas & Electric Company, Denver, Colo., and was formally opened on the evening of November 12, when it is estimated that a crowd of 100,000 spectators witnessed the impressive scene. In fact, so great was public interest in the event that street car traffic on the streets surrounding the building was temporarily suspended in order that the greatest possible number of people should be able to witness the event. The lighting of the entire building within and without was

FIG. 1.—THE NIGHT ILLUMINATION OF THE NEW BUILDING OF THE DENVER GAS & ELECTRIC COMPANY, DENVER, COLO.

consummated by the press of an electric button by Mayor Speer at 8 o'clock. The exterior decorative lighting requires the use of 13,000 lamps, representing 200,000 candle-power and 2500 horse-power in energy; 250 miles of wire supply the current. The evening was devoted to a general reception of the public on the part of the various officials of the company, and as an example showing the way they do things "out West," 100,000 carnations were passed out as souvenirs.

We cannot refrain from repeating here a statement made elsewhere in these pages, that the Denver Gas & Electric Company was the first central station to establish a department of illuminating engineering for the use of its patrons. The magnificent building, with its unparalleled decorative lighting, is only another and more popular exhibition of the progressiveness of the company.

The Illumination of a Knitting Mill

By S. H. Knapp.

The textile industry, which now stands first in number of employees and value of product among the great industries of the country, presents a less varied field of illuminating engineering than is to be found in mechanical or other manufacturing lines. The fundamental operations are the same whatever the nature of the finished fabric, and the same general requirements in illumination hold. Whether cotton or other fiber is to be woven or knitted into the finished article, the preliminary processes up to the finished yarn are the same; and so far as

FIG. 1.—WINDING DEPARTMENT, FULD AND HATCH KNITTING MILL, COHOES, N. Y., SHOWING EFFECT OF COOPER HEWITT ILLUMINATION.

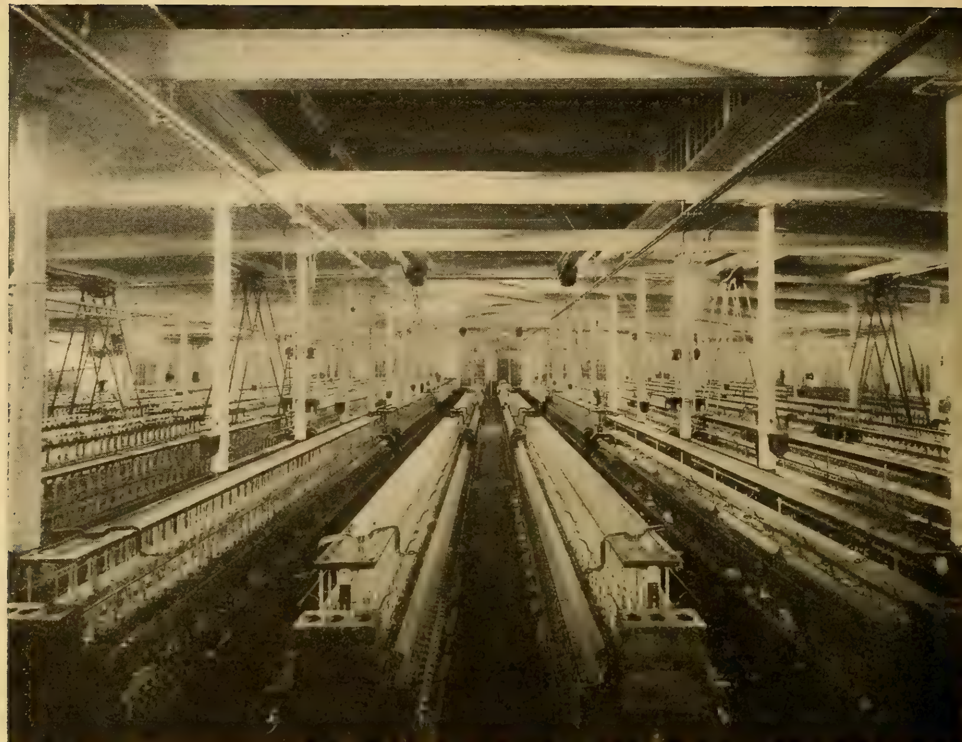


FIG. 2.—SPINNING DEPARTMENT.

illumination is concerned, there is practically no difference between knitting and weaving.

The textile industry as a whole is distinguished by the delicacy of the operations. There is no coarse or heavy work in any stage of the process; even handling the raw material does not involve the discomfort and rough work that constitutes so large an element in the iron and steel industry. While there are, of course, many operations in the metal industries that demand keen vision, they are very few as compared with the delicate operations in the textiles. In fact, the most delicate operations in mechanics are gauged by the sense of touch rather than the sense of vision, as in the use of calipers and micrometer gauges. In the textile industries accurate vision is required throughout, except in the few preliminary operations.

The first of all considerations, therefore, in providing artificial illumination is to secure the *quality* which will afford the eye the greatest facility for continuous sharp vision. Physiologically, sharp vision means the focusing of the eye upon an object within close range, and this means both muscular and nervous tension. The intensity of illumination must be sufficient, but unusual care must be taken to prevent excessive illumination, which will strain the organs of vision quite as severely as insufficient illumination.

Glare is particularly destructive to the essential quality of illumination for this class of eye work. Where the eye is not required to maintain an accurate focus upon near objects it can withstand the contraction of the pupil and the retinal discomfort of glare with comparatively little annoyance, but to require short focusing in the presence of these counteracting influences is a double strain upon the visual apparatus.

Flatness of field—in other words, uniform illumination from light received at all angles—is another fault that is particularly objectionable in textile work.

The separate threads or delicate parts of the machinery are distinguished mainly by the relief produced by lights and shadows, and to the extent that these contrasts are reduced accurate vision becomes difficult. The illumination must have a sufficiently directional quality to produce distinct relief in the elements of the surface upon which the eye is focused.

The fact that the bluish-green light from incandescent mercury vapor materially increases visual acuity at all working intensities of illumination has been conclusively proven. Light of this quality, therefore, possesses a distinct advantage for illumination of textile works. To this feature, which at the present time is found only in one commercial light-source, the Cooper Hewitt lamp, must be added freedom from glare, and a greater transparency of shadows, the latter being due to the fact that the eye distinguishes objects plainly under less intensity of illumination by blue or green light than by white or yellow.

The installation shown herewith may be taken as typical of a moderate sized textile plant. In this case the plant produces knit goods. There are three floors, each 125 x 208 feet, with 16-feet ceilings. Each of these floors is lighted with 18 type F lamps, consuming 400 watts each. The specific consumption is therefore 0.3 watt per square foot of floor area. The general effect of the illumination is well shown in the photograph. Fig. 1 shows one section of the winding department; Fig 2, a section of the spinning room; Fig. 3, a similar section in the carding and roving department; Fig. 4 is a view in the power plant.

As a matter of fact, the artificial illumination in all of these departments is superior, so far as practical use is concerned, to the daylight illumination, which, except on the upper floor, is re-

FIG. 3.—CARDING AND ROVING DEPARTMENT.

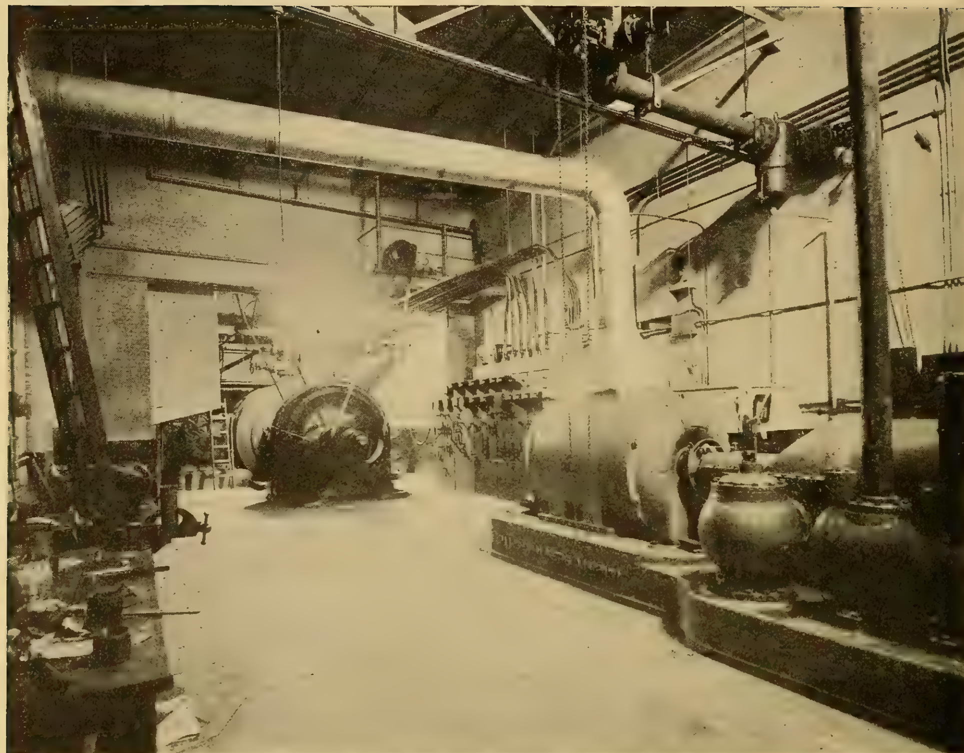


FIG. 4.—POWER PLANT.

ceived only through side windows. As would be expected from such conditions, the quality and quantity of the output is entirely unaffected by change from natural to artificial light.

It is a rather interesting fact that in Belgium it is forbidden by law for female operatives to be employed on lace and other fine textile work by artificial light, while in this country there are plenty of highly intelligent, skilled operatives who prefer to work by the artificial light of the Cooper Hewitt lamp, even to the best daylight illumination. As a triumph of science in beating nature at her own game this fact is impressive.

A Significant Action

By Ralph Birchard.

Early in the month of November a significant action was taken by the Municipal Affairs Committee of the Omaha Commercial Club. This was nothing less than a report on the lighting of Omaha with a recommendation to the Club that it should appeal to the Nebraska Legislature for an amendment to the Omaha charter making it possible for the city authorities to raise the street lighting to a uniformly high standard. The significance lies not so much in the action itself as in the fact that it is typical of the activity of all commercial clubs and other organizations working for the betterment of their municipalities.

The report of the committee is, in part, as follows:

"It is generally conceded that the first expense of standards and installation

should be borne by the property owners or business houses benefited, after which the city should bear the cost of maintenance for the reason that the whole city will benefit by the improved condition. It is much to be regretted that the charter limitations now prevent the city from taking the matter up at once.

" But this gives the Commercial Club an opportunity to show that it is alive to the importance and value of such an improvement, not only in the actual better lighting of the streets, but in the excitation of civic pride. Well lighted streets are recognized as prime factors in the retail business, and while some side streets could not possibly be made busy thoroughfares by any lighting, it is a matter of history that the heavier volume of travel takes to the better illuminated side of any street.

Even in the matter of health street lighting has its influence as the tendency to litter up a brightly lighted street is much less than with a dark and unattractive roadway. This is true even in the residential districts. Good light unquestionably increases the value of property by making streets more desirable and safer for night travel. Any one of our downtown streets can be doubled in value by the installation of lights.

" In the better illumination of Omaha's streets uniformity must be the keynote, and uniformity must govern in the choice of a suitable standard."

Ventilation of Arc Lamps

By K. A. Albrecht.

As long as we have not discovered the secret of the fire-fly and are not able to produce light without heat, we have to carefully design our lighting apparatus in regard to proper construction around the arc and suitable ventilation.

The parts in immediate vicinity of the arc should consist of heat resisting material and a circulation of cool, fresh air is to be provided, which keeps the temperature of the parts near the arc low enough to secure the durability of the construction.

No matter how ingenious the design of the lamp is otherwise, if the important factor of " cooling surface " is not properly taken care of, the lamp will soon fail in reliability of service.

Neglects of this kind in the design are often not noticeable in the first few months of the operation of the lamp, but are sure to show up in the course of time.

Flaming arc lamps present an especially interesting problem in this respect.

The flame carbons now in use not only liberate in their operation a considerable amount of heat but also solid matter contained in the core (calcium fluoride), which is actually instrumental to produce the high luminous efficiency of the flame arc.

The problem of the constructor is a double one.

In the first place, he must provide sufficient cooling surface to keep the metallic parts and the insulation near the arc at reasonably low temperature, and, second, he must provide an artificial draft or other

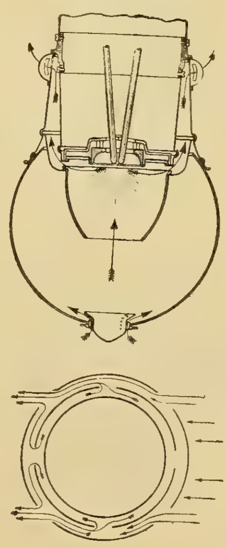


FIG. I.

means to carry away or settle the fumes and hot gases.

If sufficient care is not given to this detail the metal parts will soon be warped, getting lose and being attacked by the acid contained in the fumes; the solid matter will, settling inside of the globe, obstruct the light, also form a heat-retaining coat on other parts which will, as it is getting thicker in the course of time, seriously reduce the cooling surface of the lamp.

Attention is often not given to the effect of heavy winds and storm on the artificial draft provided for the withdrawal of the products of combustion from the interior of the lamp.

A very clever arrangement for absolute effective ventilation, even in strong wind and storm, is shown in Fig. 1.

The upper ring to which the globe is fastened has four rectangular holes and is closely fitting, with its upper rim against its seat in the case.

The fumes and gases of combustion go through these four holes, but do not enter directly into the open, but first pass into the so-called suction chamber, which has four openings which are placed under 90 degrees against the four holes of the upper globe ring.

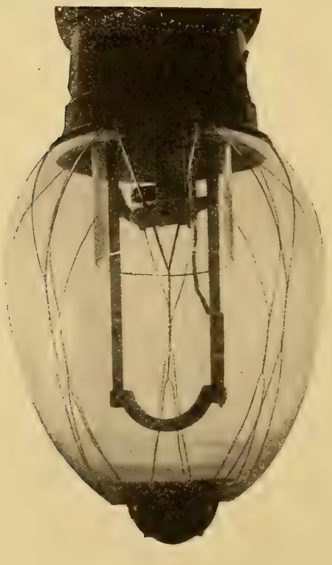


FIG. 2.

FIG. 3.

In stormy weather a draft will be set up by the wind blowing into the openings of the suction chamber being guided over the holes of the globe ring, and so causing a suction similar to the well-known injector, withdrawing the production of combustion from the globe and cooling all parts near to the arc effectively.

Fig. 2 shows a vertical carbon flaming arc lamp fitted with suction ventilation.

The lamp has been operated out of doors for 50 hours without cleaning.

There are only a few traces of deposit noticeable on the inner globe and outer globe.

Fig. 3 shows the same type of lamp operated the same number of hours, but without suction ventilation.

There is no electrical phenomena more sensitive to changes of temperature than the arc, and every improvement which tends to secure stable and well controlled conditions for the arc is an important step in advance of the art of arc lamp construction.

The above described suction ventilation is unquestionably one of the most important details added lately to the elements of construction of flaming arc lamps.

FIG. I.—NEW ENGINEERING BUILDING OF THE NATIONAL ELECTRIC LAMP ASSOCIATION, SHOWING EFFECT OF THE ILLUMINATION OF THE LAMP TEST RACKS BY NIGHT.

A New Headquarters For the Engineering Activities of the National Electric Lamp Association

By Roscoe Scott.

It is a significant fact that ever since its foundation the incandescent lamp industry, in the United States at least, has been increasing at a rapid rate, and nearly in a geometrical ratio. Considering this steady growth, it is not surprising that the men at the head of that group of manufacturers, which constitutes the National Electric Lamp Association, discovered a couple of years ago that the engineering department of the Association was fast outgrowing its quarters. At that time, the department was housed in the one-story brick structure formerly used as a factory building by Mr. Chas. F. Brush and known locally as "the old Brush electric light plant."

The Association was taking on a greater number of technical graduates each year and its engineering activities were increasing with the enlargement of the member companies' business to such an extent that a large modern Engineering Building became absolutely necessary.

As a result there now stands at the corner of Hough Avenue and East Forty-fifth Street, in Cleveland, the edifice shown in Figure 1. Its site includes that of the former one-story building, which was razed in order to make room for it. Preliminary work was started on the new Engineering Building late in the summer of 1909, and by June 9, 1910, the entire engineering department had moved back from its temporary "winter quarters" on Willson Avenue and was once more in full swing at the old location, but within new walls and with improved facilities.

The reader will doubtless exclaim on looking at the night picture: "Is a carnival of light being held on the roof?" and he will not be the first person who has asked that question. Indeed, since the completion of the building, several fire alarms have been pulled in by innocent parties, who thought that *something, somewhere,* was on fire. As a matter of fact, the light issues from the test rack rooms of the engineering department, where sample lamps, selected every month from the output of each of the member companies, are burned twenty-four hours a day in order that the manufacturers may make sure that quality is being maintained and improved.

It may be of interest to know that at present approximately 2,300 lamps are thus tested every month, and that over 400 tests, each test comprising from one to a dozen lamps, are always on the life racks. In order to determine the variation of candle-power with age, some 18,000 photometric measurements are made every month.

Reverting to the impressive illumination produced at night by the light streaming from a glass-walled test rack room, an interesting effect has been observed on the several evenings when a flag was waving from the pole seen in the picture. A person standing on the ground within fifty yards of the building cannot see whence the light originates, but he sees, a hundred feet above him, the Red, White and Blue brilliantly illuminated by invisible means—and that splendid title of the emblem—"Old Glory"—may come to mind as he gazes.

As we have started the consideration of the Engineering Building with the roof, it may be well to alight there, step inside, and proceed downward. Figure 2 gives a glimpse of the interior of the rack room. These racks, which are made of non-combustible material throughout, are believed to be the second largest in the world, and to be second in design and construction to none in the world. They contain 4,200 standard Edison receptacles or sockets; 250 miniature and candelabra receptacles and 80 large street series receptacles.

Since the lamps tested are typical of many different classes of service, they differ widely in their voltage ratings, which

FIG. 2.—CLOSER VIEW OF TESTING RACKS.

FIG. 3.—OFFICES OF ENGINEERING DEPARTMENT.

range from two or three volts up to over 260 volts; provision must, therefore, be made for supplying constant voltage of these different values to the various strings of lamps. This is accomplished in the case of the alternating current racks by placing each string of five sockets on the secondary circuit of a 750 transformer, the primaries of all these transformers, of which there are a thousand, being fed by a 200 k. w. a. c. generator in the basement. A Tirrill regulator prevents the voltage at lamps from fluctuating more than 0.2 per cent. above or below normal. The sole purpose of all this expensive electrical equipment is to insure that the lamps shall be tested under exact and uniform conditions.

An auditorium, sixty by forty-eight feet, equipped with blackboards, a lecture platform, a large projecting lantern and even a piano, is centrally located on the third floor. Here meetings are held for the discussion of subjects pertaining to electrical or illuminating engineering, and lectures, at which new photometric apparatus is sometimes demonstrated, are given before the local technical men of the Association.

A portion of the engineering department, on the second floor, where the test results are indexed and worked up in the form of reports may be seen in Figure 3. The automatic voltage recorder seen on the pillar in the centre of the room is connected with the supply circuit of the racks on the roof. In the background is a cabinet in which are kept "freak" lamps and obsolete types of lamps and reflectors—a sort of museum of incandescent lamps and their fittings.

On the second floor is located a large amount of specialized photometric apparatus, of which the limits of a general article forbid more than a mere mention. The physical laboratory of the National Electric Lamp Association also has branch rooms on this floor, in addition to a separate building of its own, the roof of which can be distinguished in the foreground of Figure 1. In still another room members of the engineering department prepare illumination plans and specifications for customers of the several member companies, upon request of the latter.

Figure 4 shows the technical publicity office on the first floor, where data on lamps and their properties and applications are checked and compiled for technical publications. Closely related to this work is that of a bureau which compiles and indexes material for illustrated lectures. Another group of technical publicity men engineer the exhibits given by the Association at all large electrical shows.

The Engineering Building is illuminated throughout by means of tungsten lamps and prismatic reflectors, mainly of the intensive high efficiency type. Fixtures of simple design and dull finish are used, harmonizing well with the general interior architecture. The lamps are for the most part of the 150-watt size, spaced in rectangles about 8 feet by 10 feet and hung from 9½ to 10 feet above the floor, depending on local conditions. Baseboard receptacles in all the rooms facilitate the use of portable electric appliances.

He who would gain an illuminating conception of the progress made by man since that primeval age when his architectural ability was limited to the fashioning of a hut—when his knowledge of electricity was summed up in a wondering fear of the thunderbolt and when a flickering flame was his only means of artificial illumination—such a person should station himself some evening at the corner of East Forty-fifth Street and Hough Avenue in Cleveland, Ohio, and view the structure which looms up irradiating the heavens. Thoughts will flash through his mind concerning the comforts and pleasures that we owe to illuminating engineering in its broadest sense, and withal a feeling of thankfulness that scientists, engineers and manufacturers are co-operating in an endeavor to give us more and better light.

Verily, "the light shineth in darkness, and the darkness comprehended it not."

FIG. 4.—TECHNICAL PUBLICITY DEPARTMENT.

Fixtures and Accessories

Art Nouveau from the German Viewpoint

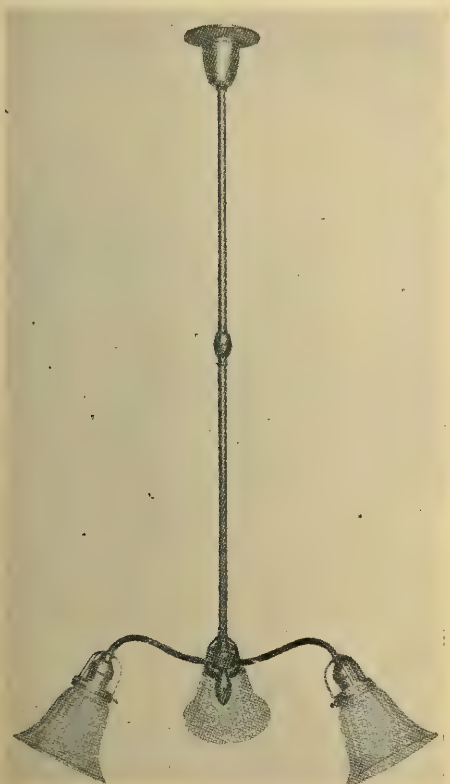


FIG. I.

Who will undertake to draw a portrait of a typical American? To give a delineation of a typical American character would not be an especially difficult task, but the character has not yet produced a distinct physical type. We are a conglomerate race, and the American face is as yet a composite picture, in which may be vaguely seen faces of various races. The outline will, in the course of time, become more distinct, and at last assume a definite delineation; but for the present we must be content to be distinguished by our mental and moral characteristics rather than by our facial expression.

Not having crystallized a distinctive physical type as yet, it is perhaps but natural that we should not yet have created either a distinctly American literature or art. The "Yankee," which forms the basis of the American ideal, is known

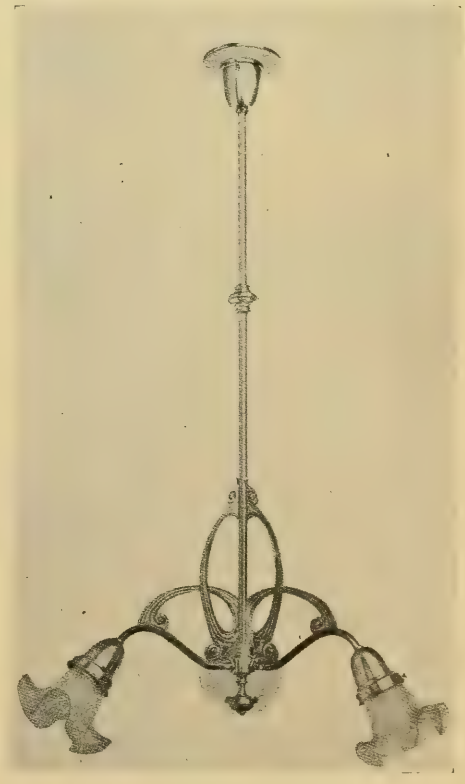


FIG. 2.

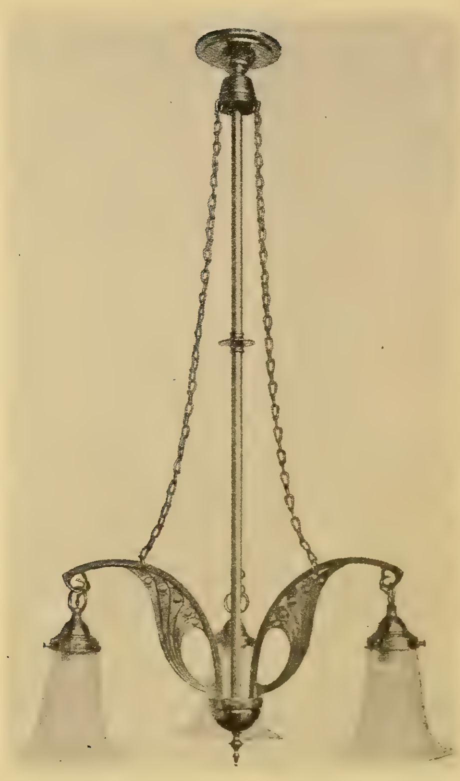


FIG. 3.

for his inventive faculties and his ingenuity, and any one at all conversant with the art of inventing knows that nine-tenths of the inventor's skill is in borrowing the ideas of others and converting them to one's own use. The American is of all things an expert copyist, but with this peculiarity, that he is not constrained by any inherited sentiments or ideals in making such adaptations or combinations in his copy as he sees fit; he copies the idea rather than the thing. Analysis would show this to be the foundation of the tremendous achievements of America in material progress.

In the application of art to material conditions this imitative habit finds full play. Our architecture is a composite as vaguely, and often as grotesquely combined as are our features; and our decorative arts thus far have no other flavor of our country than this facility in imitation. What the English touches he Anglicizes; what the German produces is as Teutonic as his language; the Frenchman could not possibly by imitation bring forth an artistic creation lacking in lightness and grace, and the Scandinavian gives an unmistakable Norse touch to all that passes through his hands; but the American is not only satisfied, but quite elated, if he succeeds in reproducing the artistic features of other peoples or ages, like the small boy who makes a drawing and is quite flattered when its true intent is recognized without the necessity of inscribing it, "This is a horse."

In previous issues we have reviewed the products of American fixture manufacturers as exhibited in their published catalogues. As a matter of general interest rather than practical information, we this time turn to the catalogue of one of the leading German fixture producers, and pass it briefly in review. The first distinct impression upon thumbing over the pages is, that from cover to cover the so-called "new art" completely dominates

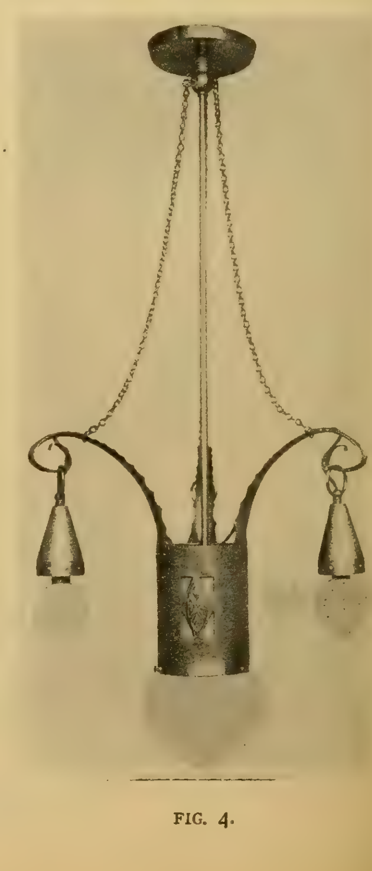


FIG. 4.

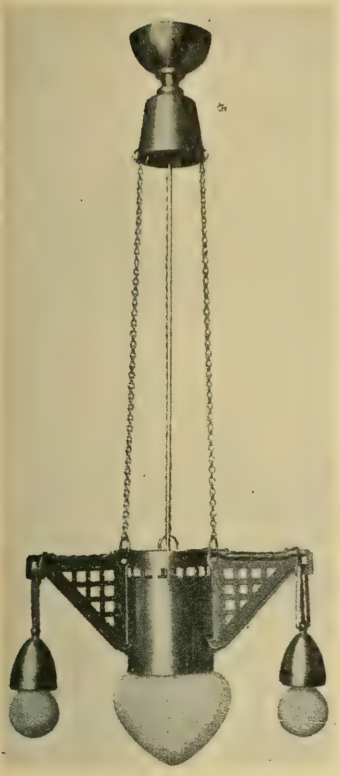


FIG. 5.

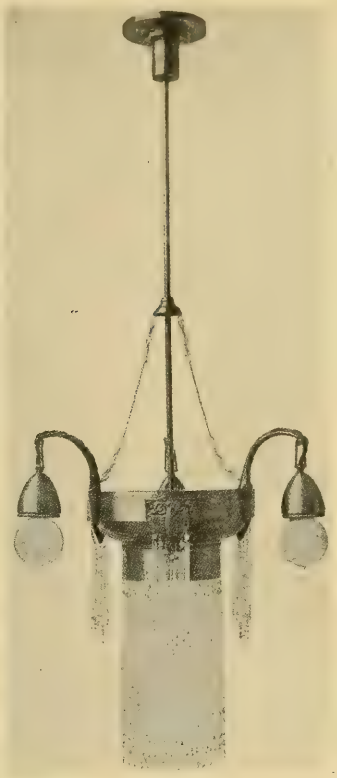


FIG. 6.

FIG. 7.

the designs. The variations of the traditional chandelier with its stiff central support and branching arms are very little in evidence, and such as do appear are distinctly under the " modern " influence. The second observation is the decidedly German accent possessed by even the simplest of the designs. There is no need of looking for the familiar inscription " Made in Germany "; it would be like asking Mr. Fritz Kazebier if he was a German.

A word as to the Art Nouveau, " new art " or " modern "—the several phrases used to designate the same school. This school of art is first and foremost a school of " insurgents " in art. It declines positively to follow any particular precepts or principles of any preceding period or school, and maintains its right of selecting its motives from every possible source, —from all previous art, as well as from the whole field of nature. It also gives a much freer rein to its expression than former schools. It is possible out of this infinite mass of materials to construct consumate ugliness, as well as beauty, and illustrations of this fact are not wanting. But where there is a conception of beauty in the mind of the artist he is at liberty to embody it forth in whatsoever form and outline he chooses without heed of the tenets of any master. Whatever else may be said, the " new art " at least has the virtue of being new.

In Fig. 1 we have an example of the simplest possible expression of the new art in fixture design. There are but three elements in this fixture which are distinctly decorative—the canopy, the bead in the middle of the supporting tube, and the terminal of the tube below the arms. But even as simple as these elements are, they are distinctly different from the forms which such elements would take in a similar American fixture. In the latter

case we would find the canopy nearly hemispherical in shape, the centre bead replaced with an ordinary wall canopy, and a ball in place of the pointed curve at the bottom; and yet as trifling as this difference is, it distinctly changes the effect of the fixture. There is no denying that the new art has the advantage in this case.

Fig. 2 shows a more decided effort at decorative treatment. The braces of the arms are highly characteristic of the new art, and have the additional merit of being mechanically sound in their outline. In other words, they serve as actual substantial braces, as well as decorations. The effect is, therefore, very satisfactory.

Fig. 3 is another simple design, in which the bracing of the arms is equally effective, mechanically and artistically. The shape of the glassware is well chosen, and the bead in the centre of the stem a particularly happy touch.

FIG. 8.

FIG. 9.

Fig. 4 shows a distinct variation in the mechanical construction of the fixture itself, a large central lamp being the principal feature, about which are suspended three smaller lamps. This construction is in accordance with sound illuminating engineering principles, the central lamp serving the purpose of general illumination, except when especial brilliancy is required, when the smaller lamps can be brought into service. This is a decided improvement upon the practice of lighting a single lamp on one of the arms of a fixture, which throws the whole thing entirely out of balance. The lines are in excellent harmony, and the spirit of the hammered metal craftmanship well carried out.

Fig. 5 illustrates another fixture on the same principle, but of much bolder design. In fact, this design is so strong of the new art flavor that it may require a little cultivation of taste, like that for certain German cheeses, before it can be

fully appreciated. It would harmonize splendidly with the work of a prominent western architect, whose buildings are noted for their originality and departure from established precedents.

Fig. 6 bears evidence of the wide latitude of choice which the new art exercises. Here we have a combination of the hammered metal decoration with glass prisms, a combination which surely proves that the designer had the courage of his convictions. No timid copyist would ever have dared to put these two motives in combination. The general outline of the fixture is also distinctive. Even prism glass is not considered without the pale of art of this new school, as is shown in Fig. 7. There seems to be this difference in this respect in German and American practice: the German hammers, the metal; the American fixture designer has generally "hammered" prismatic glass.

FIG. 10.

The so-called "shower" type of fixture, which has recently become so popular with us, was known in Europe some years ago, and has been largely used. Fig. 8 shows a new art treatment of this type. Is it a thing of beauty, or is it not? That depends upon your own taste. Only, in making your judgment, remember that the very latest style in feminine apparel looks strange and ugly until you become accustomed to it. There are no theoretical objections to the esthetics of this particular fixture.

In using the candle as a motive, the designer of the fixture shown in Fig. 9 has been much more consistent than the majority of American cases. The candlestick is shown in its entirety, and the flame is simulated as closely as possible in the form of the lamp bulb. The lines here are good, and the impression distinctly pleasing at first sight.

Fig. 10 shows the candle motive worked out in an exceptionally happy manner in a fixture for ecclesiastical use. The seven-branched candle-stick of Mosaic times being utilized in an ingenious manner.

We have examined but ten cases out of several hundred presented in the catalogue, but they will perhaps serve to give some impression of the present trend of art in lighting fixtures in the German Empire.

Research and Investigation

Microscopical Phenomena of Transmitting and Reflecting Media

Conducted by Francisco Laurent Godinez and Albert Jackson Marshall.

Previous investigators have established as a matter of scientific record the variations in the distributions of light flux with reference to the surface conditions of secondary radiants.

It is apparent that a distribution curve resulting from the redirectional impulse of primary light flux may be modified to considerable extent if it is accomplished by specular reflection, due to a polished secondary radiating surface of either opaque or translucent media. It has also been shown that secondary radiating surfaces dependent upon the phenomena of diffuse reflection do not materially modify the secondary distribution of light flux below the horizontal. These conclusions, however, have been based upon a purely superficial consideration of surface conditions in the transmitting and reflecting media and without particular regard for the actual structural phenomena of said media.

In such investigations the ultra microscope affords a means of rendering visible the most minute particles. It has been

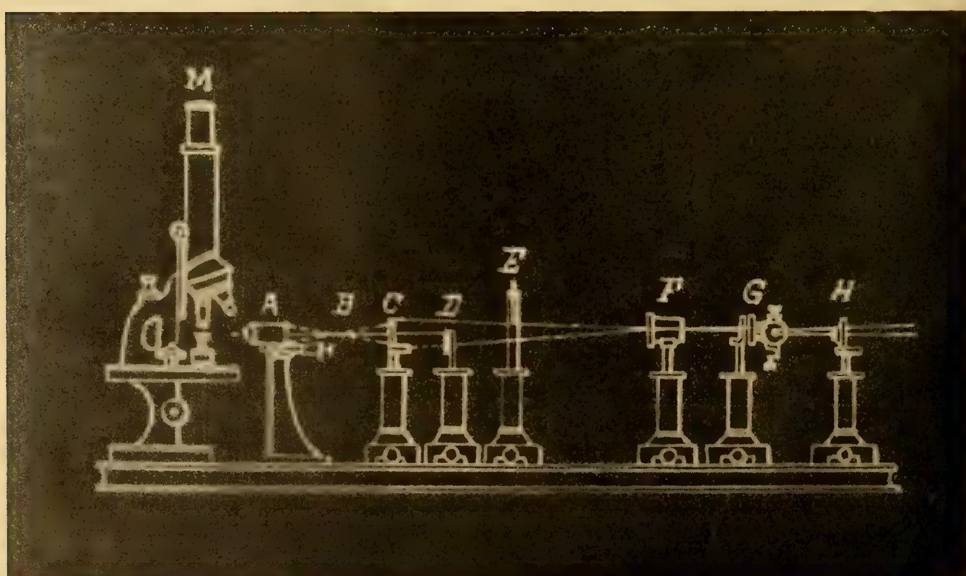


FIG. I.

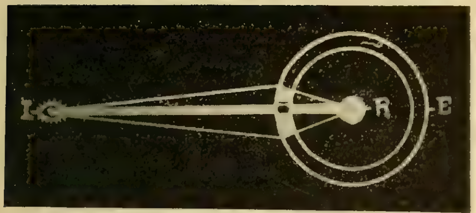


FIG. 2.

shown by a number of examples how the particles of a solid, such as metallic gold, change with progressive subdivision, especially if the subdivision be carried to a degree approaching molecular dimensions.

Professor Richard Zsigmondy, professor of inorganic chemistry at the University of Göttingen, has developed the subject of ultra microscopy with reference to irreversible colloids, and as the result of his research and experiments in the precipitation of collodial gold has been enabled not only to observe the size and color of the particles, but also to view their motion.

In another research with reference to the amicroscopic nuclei in colorless ruby glass the gold particles, like those in collodial solutions, were visible upon spontaneous crystallization. A description of the ultra microscope employed by Dr. Zsigmondy follows:

It is evident why, in previous microscopic observations, individual particles in collodial solutions or in ruby glass could not be seen, since with transmitted light the eye is dazzled and the divergency between the resultant differences of briliancy in the objective field is directly caused by the diffraction of light, due to very small particles. To render visible these particles it is necessary that they should be intensely illuminated without

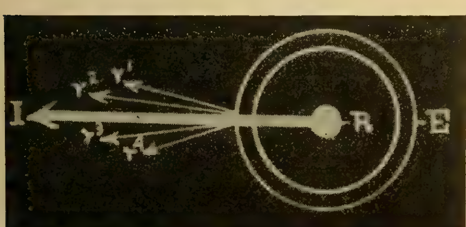


FIG. 3.

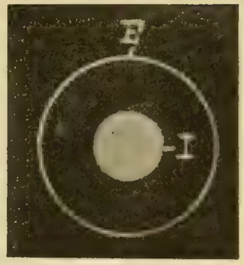


FIG. 4.

any direct radiation entering the eye, and that the contrasting objective field shall be as dark as possible. Figure 1 shows the apparatus employed.

Solar rays reflected from a heliostat enter the darkened laboratory through an iris diaphragm on an optical bench about 1.50 meters in length, equipped with a metal flange supported on an adjustable on which carefully adjusted pedestals hold the individual mechanism of the apparatus. The light rays first enter the telescope objective H of a focal length of about 19 mm.; a resultant image of the sun about 1 mm. in diameter is thrown on a micrometer slit-head G1 (adjustable). By manipulation of the horizontal bilateral slit the solar image may be reduced to 5.50 hundredths of a millimeter. The width of the slit is observable on the micrometer attached to the drum connected with the screw. The edges limiting the height of the slit are moveable horizontally, admitting of a varia-

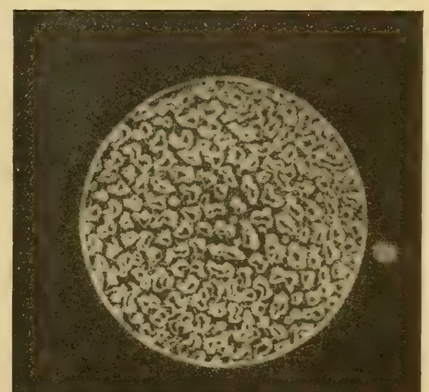


FIG. 5.

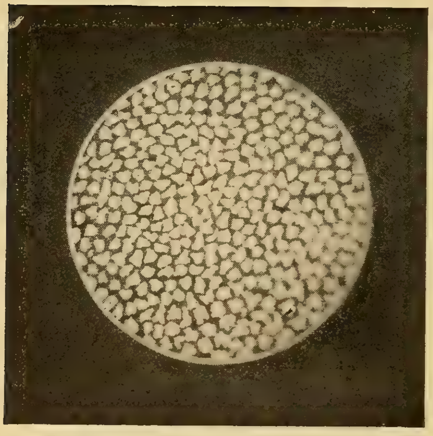


FIG. 6.

tion from 1-10 to 2 mm. apart. A polarizer F may be placed behind the slit when desired. E is an iris diaphragm acting like a photometer screen and excluding any extraneous lateral light flux which might be reflected from the edges of the slit. By manipulation of the chisel-shaped diaphragm D one-half of the incident beam of light may be cut off, which is necessary when immersion objectives are used in order to prevent distortion from the closeness of the objective. A second telescope objective, C, of 80 mm. focal length forms a quarter size image of the slit at the focal plane B, at the Abbé condenser, A.

By means of the primary microscope objective used as a condenser the picture B (reduced to 1-9 its size) is projected into the subject for analysis. Full use should

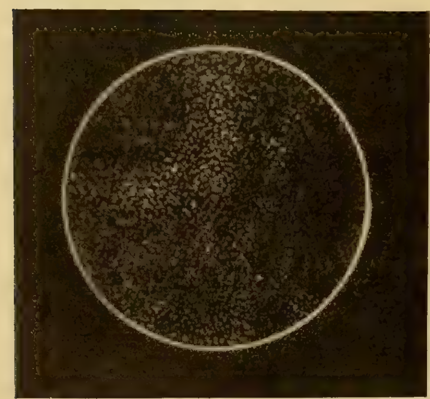


FIG. 7.

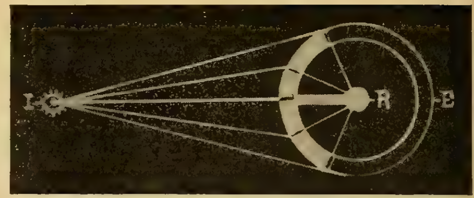


FIG. 8.

be made of the variable apparatus in the condenser system A1 by controlling and modifying the illumination of its posterior plane.

By means of two micrometer screws working in a horizontal plane and perpendicularly to each other the condenser-objective may be readily centered in the optical axis of the microscope proper. In order to bring the desired portion of a solid into the axis of the illuminating beam Siedentopf has devised a metal prism with slides which permit the vertical micrometric motion of a minute plane, analogous to the familiar mechanical stage of the ordinary bacteriological microscope.

In the examination of spontaneous crystallization in ruby glass Dr. Zsigmondy recalls the well-known analogy existing between the formation of ruby glass and the devitrification of amorphous substances. Differentiating between amicroscopic and sub-microscopic particles with reference to "perfect" or "inferior" ruby glass it shows that the individual particles appear much brighter and further apart than in the case of the former.

The apparatus employed by the authors in their research work is a modification of the ultramicroscope described above, with the addition of a microphotoscopic attachment; and the conclusions derived and hereinafter set forth represent a

FIG. 9.

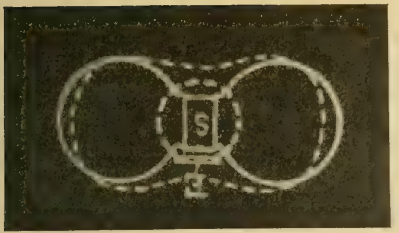


FIG. 10.

presentation of the data obtained from the ultraphotomicroscopic examination of "milk" glass.

The microphotogravures depicting the structural phenomena of ground and acid etched glass were obtained from observations made with a standard bacteriological microscope equipped with a class A objective and a Huygens eye-piece Nos. 2 and 4. An Abbé condenser was used, with a special correction for chromatic aberration, and also an iris diaphragm fitted to the microphoto attachment direct.

Before proceeding to a consideration of the microphotographs showing the structural phenomena of ground and acid etched glass, attention is directed to the accepted theory of diffraction within such media as defined by Dr. C. P. Steinmetz.

In Figure 2, R represents a theoretical radiant within a totally inclosing envelope of ground or acid etched glass E. A pencil of light from the radiant R upon emergence in the direction I maintains its initial linear horizontal direction, but at a slightly reduced intensity. Upon emergence there is also a slight scattering of the rays as indicated in Figure 3. It should be noted that the dispersion

FIG. 11.

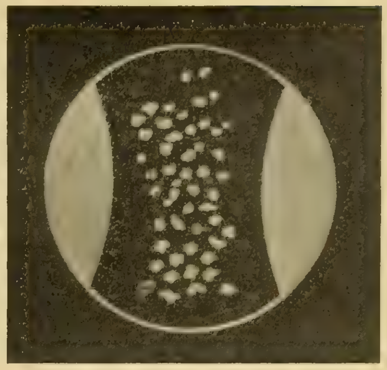


FIG. 12.

is symmetrical with reference to the horizontal axis of the emerging ray. From this it is evident the inclosing envelope appears to the eye as indicated in Figure 4, the radiant assuming the appearance of an enlarged bright spot of light in the center of a practically non-luminous inclosing envelope. This explains why ground or acid etched glass is inappropriate in any form where a uniformly luminous spherical surface is desirable, unless a radiant of low intrinsic brilliancy is employed.

Figure 5 is a microphotogravure of a ground glass plate; and by studying it carefully it is obvious why the pencil of light from the radiant R emerges as indicated in Figure 3. Naturally light acid etching produces an aggravation of the spot light effect on the surface of the secondary radiant, and this also is clearly shown by the microphotogravures in Figures 6 and 7, respectively, the former representing fairly dense acid etching, and the latter a very slightly depolished surface. This particular microphotograph was only obtained with considerable difficulty, since in order to reproduce the observed surface effect it was necessary to operate with a very dark objective field, thereby admitting insufficient light to the sensitized plate for any accurate reproduction of detail.

In Figure 8 the radiant R is inclosed within an envelope of milk glass, and upon emergence, while the horizontal linear direction is maintained the intensity, however, is greatly diminished in the direction I. Consequently the sur-

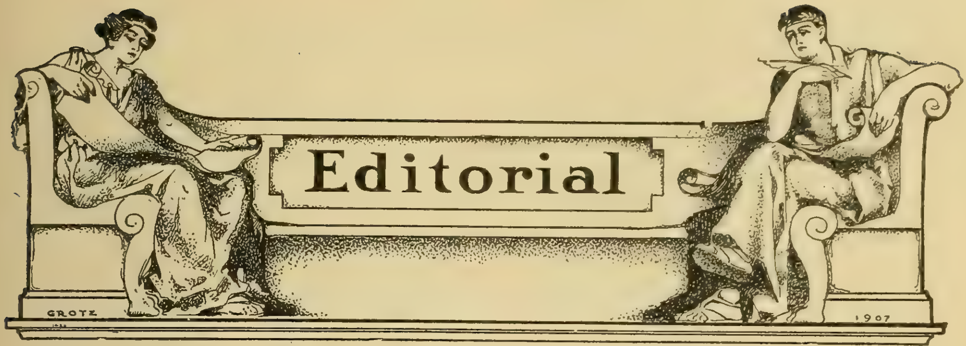
face of the envelope appears uniformly luminous, with the exception of a very minute central spot of light, invisible at a distance. When the envelope is of thin opal glass, and the radiant is an incandescent lamp of the carbon filament type, the filament is likewise visible at close range, exhibiting the characteristic red color due to the translucent phenomena of opal for red waves.

Figure 9 shows the redirection of light flux by the action of the suspended particles of opal in milk glass, and a pencil of light emitted from the radiant R upon emergence is redistributed with a maximum value at right angles to any tangent drawn at the point of emergence. From this it is evident that with an inclosing envelope of milk or opal glass the redistribution of light flux from the secondary radiant will be symmetrical with reference to the form of the inclosing envelope. This is, however, not equally true with ground or acid etched glass, and in Figure 10 S represents a theoretical cylindrical radiant, giving a distribution of light flux as indicated by the unbroken line. The redistribution of light flux designated by the broken line illustrated the action of ground or acid etched glass when in the form of a spherical inclosing envelope. It is evident that the horizontal light flux from the secondary radiant is diminished on the horizontal, due to absorption, but aside from this variation the symmetry of the primary distribution is practically unmodified.

Referring now to Figure 11, the broken line indicates the approximate redistribution of light flux by ground or acid etched glass in the form of a stalactite, and it is evident that the curve is symmetrical with respect to that of the theoretical primary radiant in Figure 10, and remains unaltered by the contour of the secondary radiant, or inclosing envelope of ground or acid etched glass. Conversely, the unbroken line (Figure 11) represents the characteristic distribution curve obtained from an inclosing envelope of milk or opal glass, and its symmetry with respect to the contour of the inclosing envelope is apparent.

Figure 12 is a microphotogravure showing the suspended particles of opal by the aid of the ultramicroscope. The photomicroscopic attachment employed by the authors was essentially crude, and as a result this representative, while quite characteristic, does not do justice to the action of the ultramicroscope as observed by the eye.

These collodial particles of opal are oblateral in form and are disposed between the structure of the glass with the majority of their axes perpendicular to the exterior surfaces, which explains the redirection of light flux hitherto theoretically attributed to transmission phenomena in such media. The reason for the visibility of a filament within an inclosing envelope of ordinary light milk glass is due to the unhomogeneous suspension of the opal particles admitting of considerable transmission between them from impinging rays normal to the inner surface of the enclosing envelope. This phenomenon is of special interest at the present day, since the enormous increase in intrinsic brilliancy of our artificial radiants within the past few years has been quite alarming from the viewpoint of the ophthalmologist, and we have reason to expect still greater increases in intrinsic brilliancy within the next two years. It would, therefore, appear that the high efficiency incandescent metallic filament lamp of the near future will be necessarily placed within an entirely enclosing envelope of such media as will decrease the intrinsic brilliancy without destroying the reductive effort of the secondary radiating surface.



The Convention

The fourth annual convention of the Illuminating Engineering Society has come and gone, like the other innumerable events that make up the links in the chain of life. The success of a meeting of this kind is to be judged not only by the literal interpretation of the papers and discussions, but by the general spirit which prevails. As it is quite possible to have a wholly ineffectual religion while observing all of its set forms, so is it equally possible to have the outward and visible signs of a successful convention, and still have it lacking in the enthusiasm which, after all, is the real pith and substance of the gathering. Even attendance as shown by the register rolls is not a safe criterion of judgment. An enrollment of hundreds with only dozens in actual attendance during the sessions cannot be counted as a proof of prosperity.

THE EVIDENCES OF SUCCESS.

The convention of which we are speaking presented all of the characteristics of success without a single doubtful element; in fact, the success was not only in full measure, but heaped to overflowing. From the opening session Monday morning until the close of the banquet on Tuesday evening there was not a single lull in the triumphant progress of events. A Monday morning opening session of any convention is by general consent a formality of which little is expected. In this case the room assigned for the opening session was filled to its full capacity, even to the standing room, and the program listened to by the assembled audience with the closest attention.

The afternoon session, which was held in a considerably larger lecture room, showed the same enthusiasm; the regular seating capacity again proved too small for those desiring to attend. The public lecture Monday evening, which was held in the largest of the auditoriums of the university, was given to a full house, which meant that a large number of visitors were present. The reception at the Hotel Belvedere was wholly free from the perfunctory air which not infrequently pervades such functions. The sessions of Tuesday overflowed the meeting room, and the seating capacity of the banquet hall at the Hotel Belvedere proved scarcely large enough to seat the participants in the evening; the banqueters joined heartily in the college songs and general merriment until the time of the after-dinner speaking arrived, and the speakers themselves were exceptionally happy in their remarks.

The attendance of ladies could have been larger, but even this fact might be construed as an evidence of the serious purpose of those in attendance. The program of entertainment provided especially for the lady guests was an attractive one, and carried out with the same success as the more formal part of the convention.

The results as a whole were a surprise to even the most optimistic. That so large a number of men, many of whom absented themselves from important and pressing business, should take the time and incur the expense, and in many cases travel long distances, to hear the papers presented by their authors and to listen to

the discussions, all of which will duly appear later in the printed proceedings, is a wonderful testimony to the vital interest in illuminating engineering. Every one present came for the purpose of attending the convention, and no other. There was no opportunity of making the occasion one of private business with the convention thrown in " on the side."

POINTERS FOR OTHER CONVENTIONS.

The success of this convention under these circumstances may well receive the attention of other organizations in selecting their convention cities. Competition may be the life of trade, but it most certainly is not the life of a convention. If any further proof is needed of this the I. E. S. convention in New York last year may be cited. In point of papers presented, the New York convention was probably the superior of the Baltimore convention, while the entertainment program was not only the finest ever presented before a convention of this society, but one of the most attractive ever connected with any similar convention. But New York, even under normal conditions, has far too many attractions for the stranger, and last year the excitement of the Hudson-Fulton celebration simply overshadowed everything else. As a result there was a large registration with a slim attendance; and the same condition held at the last Atlantic City convention of the National Electric Light Association. We believe that the tendency is becoming more pronounced to consider conventions more seriously as important and valuable adjuncts to the particular field or profession to which they belong, and less in the light of a pleasure junket. This is an encouraging sign.

THE PAPERS.

As to the program of papers presented at the Baltimore convention, it may be that they suffered by comparison with the splendid lecture course scheduled to follow; but be that as it may, we have an impression that the program as a whole was at least no stronger than the programs of the preceding conventions. Those who have followed the rise of illuminating engineering from its inception cannot help but view some of the features of the program with a philosophical smile. For instance, the last session was given up to a series of papers intended to bring out the value of illuminating engineering to the various portions of the lighting field. To hear the claims made for the value of the science to the central station one would imagine that this branch of the lighting industry had been among the first of the pioneer workers, whereas it is only a little more than four years ago that the proffer of a paper on this same subject for the National Electric Light Association Convention was unceremoniously declined on the perfunctory plea that the " program was full "; and the same general observations might be made regarding the other papers on this subject. But human nature is the same thing, whether it is dealing with science or politics. In a recent magazine article Senator Beveridge points out that reform legislation, when first proposed, is invariably combated with every force and trick known to the professional politician; but after it has finally been enacted into law and come into popular favor, those who were most strenuous in their opposition at first are commonly found to carry the air of having been among its most ardent foster-parents. It is only a variation of the eternal truth that " nothing succeeds like success." Illuminating engineering has reached the successful stage in its career, and will henceforward have no lack of enthusiastic supporters; they will be as plentiful as the " original McKinley man " was after the lamented president had been elected and achieved popularity.

SOME SIGNIFICANT OMISSIONS.

There are two points with reference to this feature of the program which are worthy of further mention: the position of the architect and of the electrical contractor, with reference to illuminating engineering. Judged by the convention program alone these two elements are conspicuous only by their absence. The single reference to the architect among the papers was not of a cheering nature, either to the architect or the illuminating engineering profession; and as one of the members remarked in his discussion, it is doubtful if such reference will tend to accelerate the movement of the architectural profession in the desired direction. The omission, so far as the architect is concerned,

is somewhat atoned for by the inclusion of a paper on the subject of the lecture course.

The electrical contractor, however, was without any standing in this high court of illuminating engineering. In none of the proceedings was the national organization of contractors represented, nor was there any paper before the convention or in the lecture course bearing upon the subject. It is possibly best to take a charitable view and attribute this unfortunate fact to oversight. In any case, the society cannot be held wholly responsible for the lamentable fact. Surely the electrical contractor has had ample opportunity to become a member of the society; it is not even essential that he consider himself in any respect an illuminating engineer; it is sufficient that he is "interested" in the subject. It is quite possible, therefore, that the reason for his being ruled out of this court is his own default. Whatever the reason, the condition is an unfortunate one. Of all those whose business is directly or indirectly concerned with light, to none is the subject of illuminating engineering of more importance than the electrical contractor. It is an astonishing thing that he has not recognized the extraordinary opportunities which this science presents for increasing his business and putting it on a more dignified and substantial basis. This is only the reiteration of sentiments which we have repeatedly expressed, but so long as the condition exists the advice continues to hold good.

Judged as a whole, the convention was particularly gratifying to those interested in the progress of the science, for the reason that none of the several dangers which threaten every reform movement, as noted in our last issue, was sufficiently in evidence to be serious. There was a general spirit of straightforward candor and unselfish interest in the science and profession, and very little evident purpose to utilize the movement for special commercial ends. The condition of illuminating engineering and of its organized exponent, the Illuminating Engineering Society, is unquestionably in a sound and vigorous state of youthful health and spirits.

The genuineness of the welcome extended to the society and its guests could not fail to impress even the most unresponsive. The several speeches of President Remsen were as unmistakable in their cordiality and sincerity as they were inimitable in their wit and humor. The doctor is one of those exceedingly rare specimens who possesses, in connection with a thoroughly trained scientific mind, the saving grace of humor to so large an extent as to affect the salvation of all his hearers. He is both witty and wise, and withal a plain, simple-hearted, genuine man, entirely unaffected and unspoiled by any apparent consciousness of his unusual combination of talents. The convention would have missed its most charming flavor had it been necessary to forego the remarks of the genial and able president of the Johns Hopkins University.

The Lecture Course

Regarding the lecture course we can give only an *ex parte* opinion based upon comments of those who were present. Viewed purely as a course of academic lectures the success of the course apparently does not measure up to that of the convention proper. One of the lecturers, whose reputation in the particular field upon which he was scheduled to discuss is of the highest character, failed to put in an appearance. In other cases the matter presented apparently had not been well digested by the lecturer, while in still other cases there was an attempt to crowd too much into the allotted time. Historical sketches seemed to have been unnecessarily repeated. All of these are faults as applied strictly to a classroom lecture, but can be easily eliminated from the full reports which are to be published later when the editing committee will have had full opportunity to strike out needless repetitions. Lectures as a method of instruction have undoubtedly received entirely too much attention in this country. There are only three excuses for a lecture as a means of imparting knowledge: first, when the personality of the lecturer gives such added impressiveness to the discourse as to fix it in the minds of his hearers; second, when the matter presented is of such recent discovery or origin that it cannot be presented in printed form; and third, when the subjects are to be illustrated by experiments which cannot be adequately described by writing. For a

professor to stand up before a class, even though he be a recognized savant, and to simply recite information which is easily obtainable from printed books is a sheer waste of time on the part of all concerned; and this applies to about three-quarters of the lecturing that is done in our colleges and universities.

In the lecture course of which we are speaking the topics treated are all new, at least as far as any comprehensive published treatise is concerned, and there was at least this one justification for their oral presentation. The fact that they are to be embodied in a published report later, however, leaves nothing in favor of their presentation as lectures, except that they become available a few months sooner. When the lectures have been revised by the authors and by the editing committee, and duly published in book form, they will unquestionably constitute what may be rightly called an encyclopedia of illuminating engineering. But even so, their value will deteriorate by reason of the constant change in the art and science of which they treat. Illuminating engineering is the youngest of the scientific specialties, and in the nature of things must make rapid progress within the next decade. The few books thus far published on the subject have already become largely antiquated.

In the face of all these adverse criticisms, however, one vitally important fact remains, viz.: that this lecture course, by reason of the high reputation of the lecturers and the institution under whose auspices the course was given, has, in the very forceful language of the stage, "put over" illuminating engineering. Any shadow of doubt as to the right of illuminating engineering to a place among the various professions and branches of applied science has been dispelled. Illuminating engineering IS.

Instruments for Measuring Light

Science is based upon measurements. Illuminating engineering is an exact science to precisely the extent to which the phenomena with which it deals are susceptible of accurate measurement. The first attempts to measure light were necessarily crude and inexact, and no great progress was made for a considerable period of years; but with the commercial perfection of the electric lamp, which furnished a practical working standard of a high degree of accuracy, the measurement of light rapidly advanced, and to-day holds a place that may justly entitle it to be classed among the scientific measurements of precision. The first forms of photometer were clumsy and cumbersome, and suited to make the single measurement of luminous intensity of the light-source in the horizontal direction; to-day we have instruments of far greater precision, and so compact and light as to be carried about as easily as an ordinary hand-bag. These instruments, moreover, are capable of giving by direct measurement any of the photometric quantities which enter into illuminating engineering problems. The first thoroughly successful universal portable photometer was designed by Messrs. Sharp and Millar, of the Electrical Testing Laboratories, New York, and is now familiarly known under the name of the Sharp-Millar Photometer. While this instrument contained no new principle, it embodied all of the best features of the different instruments previously produced, combined with true Yankee ingenuity into an instrument at once so compact, so light, and so adaptable as to represent a veritable photometric laboratory that could be carried about in the hand. The discovery of the metal filament lamp did much toward making such an instrument possible, and Messrs. Sharp and Millar were not slow to recognize and take advantage of this fact. Their instrument is in reality a miniature photometer, having all the parts and capable of all the results of the larger instruments. It consists of a bar about 2 ft. long, with a Lummer-Brodhun screen at one end and a miniature tungsten lamp as a standard arranged to move along the bar. On the other side of the screen is a tube having a right-angle bend provided with a mirror which can be used either open, or closed with an opal glass plate. The standard light is moved by a large milled head on the outside of the box which enclosed the screen, bar and standard lamp. A translucent, direct reading scale is provided. The standard lamp is supplied with current either from dry batteries or storage cells, the correct voltage being regulated by a small resistance coil

and volt meter. The instrument can thus be used either as a direct reading photometer, as an illuminometer measuring the illumination on any given theoretical plane, or to measure the illumination or surface brightness of any given surface whether luminous or reflecting. Measurements are quickly made with a comparatively high degree of accuracy, even by the unprofessional observer.

We are led to make this review of an instrument already well known in this country chiefly on account of the attention given to a new instrument which was recently described by Messrs. Dow and McKinney in a paper read before the London Optical Society. The chief purpose of this instrument is to measure surface brightness, or intrinsic brilliancy, and both the inventors and the technical press announce that this is first instrument of the kind that is capable of making this measurement direct. The fact that this measurement can be made with a Sharp-Millar photometer with ease and precision has apparently escaped attention in England.

However, this is not the most important point; although, since the scientific investigator or inventor must often content himself with no other reward than the honor attaching to his work, it is always of interest to bestow "honor where honor is due." Messrs. Dow and McKinney have designed an instrument that for the specific purpose intended—which, by the way, is a useful and important one—apparently possesses merit of a high order. It is simple, extremely light and compact and evidently susceptible of a sufficiently high degree of accuracy for all practical purposes. The general construction of the instrument is noted elsewhere.

Every improvement and development in instruments for the mensuration of light is an important progressive step in the science of illuminating engineering, and those who are responsible for such improvements are deserving of a full measure of credit for their work.

"Out of the Frying Pan Into the Fire"

It is possible to put a good thing to a very bad use, and in attempting to improve conditions to make them very much worse. The great majority of lighting installations put in before the advent of the new high efficiency electric lamps were defective, either in not providing sufficient illumination, or in failing to secure the various elements which go to make up quality in lighting. Such installations could, of course, be greatly improved by following the most approved methods of modern illuminating engineering; but offhand attempts to remedy the defect are likely to aggravate the evils rather than to lessen them.

A most conspicuous case of this kind is provided in the Congressional Library at Washington, a general discussion of which appears in another section of this issue. In this case the high candle-power tungsten lamps have been put into the sockets originally provided for the old-time 16-c.p. carbon filament lamp. The result is an illumination that is infinitely worse than that originally provided. The general brilliancy and the glare of the lamps themselves is simply intolerable.

This building should serve as a "horrible example" of what may be expected when modern high candle-power lamps are indiscriminately substituted for the old 16 c.p. "bulb." It is all right in many cases to "raise the standard of illumination," but to raise it to the pitch of blinding glare is only "jumping out of the frying pan into the fire." The metal filament lamp, and the flaming and luminescent arcs are decided improvements upon the older forms of electric lamps in point of efficiency, and in time must wholly supplant the older forms; but they must be used with some judgment and care, or their advantages will be turned against them and converted into faults.

The subterfuge of rating these new lamps by watts instead of candle-power is a direct bid for such misuse, and in the end can serve no good purpose. Before these improved lamps came in the central stations were very insistent upon the point that they were "selling electric current" and not light. This position seemed to serve their own immediate purpose best. It never occurred to them that in the nature of things more efficient lamps would sooner or later come in, and that when they did the public would reap the entire

advantage of the improvement, since there would be no excuse for the stations making any difference on rates, as it was current they were selling and not light. When the tungsten lamp, with three times the efficiency of the carbon lamp, suddenly burst into full bloom the central stations found themselves in precisely the predicament that was to be expected; the consumers were then quite willing to buy electric current instead of light, and reduce their bills at least half; and public sentiment, embodied very generally in concrete form in the shape of Public Service Commissions, formed an insurmountable obstacle to any raise in rates. The rating of these new lamps by watts, which the consumer does not understand, instead of candle-power, with which he had become reasonably familiar, is only a weak attempt to remedy the mistake due to the short-sighted policy of the central stations in the beginning, and is just as sure to lead to trouble in the end as was the first mistake of selling current instead of light. It is quite possible that the people will be content for a time to put in a 50-c.p. lamp in place of a 16, but it will not last; the people cannot be fooled all the time, and the sooner the truth is plainly stated, and the new lamps put out on a true basis, with all possible assistance to the user by way of improving his lighting conditions—and goodness knows there is room enough—the better it will be for all concerned.

Notes and Comments

Public Interest in Illuminating Continues to Grow

THE CONVENTION AS VIEWED BY THE LOCAL PRESS

The Convention and Lecture Course which were recently held in the Johns Hopkins University received due attention in the daily newspapers of the city.

The newspaper of to-day has its particular way of looking at things. To use the popular expression, its one object is to pick out the "human interest" elements of every piece of news and with this as the framework to construct as interesting a "story" as possible. The ingenuity shown in finding heart-throbs in the ash-barrels of scientific and other matters equally dry and unintelligible to the average reader often rises almost to the sublime. To be sure, the newspaper writer is not restrained by the same rigid adherence to truth as the scientific writer, and is readily forgiven for drawing upon his imagination, provided only it proves interesting. Newspaper science cannot be recommended as a serious branch of study; but by directing attention to scientific matters it serves a useful purpose, and so there is really no sufficient cause for objection, even on the part of the devotee of science. Let us, therefore, take the several comments of the press with all the salt necessary for their complete digestion.

Here is a paragraph from the *Sun* of Tuesday, the second day of the convention:

> "Mr. Van Rensselaer Lansingh, manager of the Holophane Company, of New York, which manufactures reflectors, coined the phrase 'illuminating engineering,' and so well did it seem to suit the new science that it was adopted all over the world."

It would be interesting to know just who inspired the *Sun's* reporter. It must surely have been one of the freshmen in the profession, else he must have known that illuminating engineering, as to both the name and the thing, was in existence some time before Mr. Lansingh had ever turned his thoughts in this direction. Mr. Lansingh has been an ardent foster-father of the infant science, but he is not the godfather; the child was named before he made its acquaintance.

The following paragraph from the same source will also be news to many of the profession:

> "No exact definition of the term 'illuminating engineering' has ever been given, nor have the limits of the science been defined. This convention, which will be followed by a lecture course in illumination at the Johns Hopkins, will seek to define illuminating engineering."

Although the New York section of the Society spent an evening in discussing the question, "What is an illuminating engi-

neer?" the term "illuminating engineering" is perfectly easy of definition if one is willing to abide by such authorities as the Standard or Century dictionaries and the processes of established analogy in the formation of technical terms (see THE ILLUMINATING ENGINEER, issue of December, 1909, page 554).

Here is the impression that the *American's* reporter got from Dr. Hyde's presidential address:

"Continuing, Dr. Hyde expressed belief that the status of illuminating was backward and was not up to the march of allied sciences. Only a few decades ago it was in its infancy, and there has been great growth, but more is yet to follow. Daylight is the ideal lighting medium, and the goal is to approach this ideal as closely as possible.

"It was the president's opinion that holding up extreme efficiency as a goal was possibly a mistake."

This is rather rough on the wholly optimistic view of the situation taken by the worthy president.

The *News'* reporter showed his true sense of the "human interest" side by catching the following:

"SOUND AND LIGHT AFFINITY.

"Mr. Macbeth replied to the question of a delegate as to what effect the slamming of a door had on a certain mantle, by saying that there seemed to be some mysterious connection between sound and light, and that often some note on a piano would cause a visible effect on a burning gas lamp."

The "mystery" in the effect of certain sounds upon flames is common knowledge to the average high school boy or girl. This same "mysterious affinity," which has as little to do with illuminating engineering as the mountains on Mars, caught the *Star* reporter also. His imagination and literary turn are really fine, as the following will show:

"NEW SCIENCE PROBLEMS.

"The papers read at the convention of illuminating engineers, which closed a two-day session at McCoy Hall yesterday, were for the most part of too technical a nature to interest the general public. But, notwithstanding, there were occasional prophetic forecasts, suggestive hints of the yet unrevealed possibilities of the science of illumination, which cannot fail to touch the imagination of even those who give only a casual thought to the problems which are engaging the investigators. One delegate who was reading a paper dealing with a specialization of the light problem was asked concerning the effect of same upon a certain form of light and made the surprising answer that there seemed to be some mysterious connection between sound and light and that often some note on a piano would cause a visible effect on a burning gas lamp.

"Here is a statement of wonderful suggestiveness. Light, heat, force and electric manifestation, it can easily be demonstrated, are but variations of the same latent energy. But is sound also another manifestation of this latent quality or principle? The lay mind is prepared to believe, at least, that the science which deals with the problems of transmuting force into light, heat, driving power and possibly, also, into sound, is yet in its infancy. We are all looking trustfully to the illuminating engineers and the electrical engineers to devise methods of utilizing the latent force more adequately, extensively and beneficially than has so far been accomplished."

The following biographical note from the *Star* will interest every one of Dr. Hyde's friends, and that means the whole of the illuminating engineering fraternity:

"DR. EDWARD PECHIN HYDE, THE PRESIDENT OF THE ENGINEERS.

"Receiving his early education at City College, taking two degrees at the Johns Hopkins University and now in Baltimore as president of the Illuminating Engineering Society, Dr. Edward Pechin Hyde is a man whose career is one of interest to many people of this city. Although only 32 years old, he holds the responsible position of director of the physical laboratory of the National Electric Lamp Association, Cleveland, Ohio.

"Dr. Hyde is a great grandson of Col. William Pechin, for years the editor and publisher of the Baltimore *American*, and one of the men to whom the present high position of that journal is due. Colonel Pechin bought a controlling interest in the newspaper in 1797 and conducted it over the strenuous period when the infant republic was growing rapidly into one of the foremost nations of the world. It was under his control that the lines of the "The Star-Spangled Banner" were first given to the world through the columns of the *American*.

"His descendant, Dr. Hyde, is a son of Captain and Mrs. Edward I. Hyde, of 1100 East North avenue, and was graduated from City College in 1897 as one of the honor men of his class. His career in the university was equally brilliant and after four years of undergraduate work he conducted independent research that gained him the higher degree of Doctor of Philosophy. Then came a position in the Bureau of Standards in Washington and his present work in Cleveland."

Everybody in the lighting business knows Dr. Louis Bell, but we venture to say that few of them are acquainted with this side of his versatile character. We quote from the *News:*

"Pistol shooting and illuminating engineering seem to have little in common, but as a matter of fact one of the best known of the experts attending the Illuminating Engineers' Convention here this week, is also a pistol shot of international reputation. He is Dr. Louis Bell, who is a fellow in physics at the Johns Hopkins University, where he also took his degree. He is at present a consulting engineer in Boston. Several years ago Dr. Bell, who has taken part in many pistol shooting contests, won the Winans trophy, offered by Walter Winans, formerly of Baltimore, but now of London."

PHILADELPHIA NOW IN LINE FOR A CITY DEPARTMENT OF LIGHTING

If having "lighted the lamps" is an evidence of being awake, Philadelphia can no longer be accused of somnolence. There is no other public question that has begun to receive the amount of attention, if the press of the city is a criterion for judgment, that public lighting has received during the past two years. With its new systems now installed or well under way, and its lighting budget swelled to practically $2,000,000 a year, Philadelphia certainly has a right to some claims as to being among the best illuminated cities of this country. No small amount of credit for this public improvement is due to the chief of its Electrical Department, Mr. James E. McLaughlin. In a long article, with a page wide illustration, entitled "Philadelphia Is Now Best Lighted City Under New System," the *North American* gives the following facts in substantiation of this claim:

"Philadelphia, thanks to James F. McLaughlin, chief of the electrical bureau, is now the best lighted city in the world. With the installation of nearly 1200 new arc lights in the business section of the city, mounted on ornamental poles that add to the attractiveness of the streets, not even Paris can equal the Quaker City in its dazzling display of electricity.

"With the installation of the electric lighting system which now adorns the central section of the city, there are now in service nightly throughout the city a total of 13,060 arc lights. The new installation numbered 1129 lights at the top of artistic bronze poles, two lights to a pole."

The particular point being agitated now is a consolidation of the departments responsible for the gas and electric lighting in the city. This is a self-evident improvement, which should be provided with all reasonable expedition. What Philadelphia needs now is a Department of Public Lighting, the chief of which shall be known as the City Illuminating Engineer. In establishing such a department under the direction of such an official Philadelphia will have the distinction of being the first city in the world to recognize the science and profession of illuminating engineering, and of this distinction she will have occasion to feel more and more proud as the years go by. The present occasion offers another splendid opportunity for the Quaker City to confute the traditional joke as to her slowness.

THE "GREAT WHITE WAY" IN DIFFERENT CITIES

PITTSBURGH, PA.

The decorative lighting system constituting the White Way in this city was put into service on November 21. It includes the section of Liberty avenue lying between the Union Station and the Wabash Terminal. The installation consists of metallic flame arc lamps suspended from mast arms attached to the trolley poles. They are 45 feet apart, alternating on opposite sides of the street.

NEW YORK CITY.

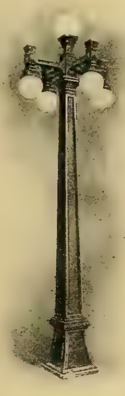
The upper section of Manhattan Island is still "Harlem" to the New Yorker, and has become an important trade and residential center. Its principal thoroughfare is 125th street, which runs straight across the island. Although it has for some time been brilliantly lighted by reason of the numerous signs and store windows, the local Board of Commerce has decided to make it outstrip the only original "Great White Way" of Broadway, if a lavish use of electric street lamps will do it. At a recent meeting of this board it was "Resolved, That 125th street should be made the 'Great White Way' of Harlem, and that to bring this about it is necessary to provide at least twice as much illumination as the street now has." It was pointed out that the present arc lights are very far apart—300 feet in some cases—and that the street cannot be made as light by night as by day unless there are lights at 150 or 100 feet intervals.

SYRACUSE, N. Y.

If a campaign which was inaugurated yesterday is successful, Syracuse will soon be the most uniformly and most brilliantly

lighted city of its size in the United States, as far as its business section is concerned.

Under the direction of George D. Kirtland, chairman of the Chamber of Commerce Committee on Ornamental Street Lighting, numerous sub-committees were appointed to make a store to store canvass of the principal business thoroughfares in an effort to secure a uniform extension of the system of ornamental lights established as an experiment in the 300 block in South Warren street a couple of months ago.—*Post-Standard.*



EIGHTY-SIX OF THIS TYPE OF STANDARD ARE TO BE INSTALLED BY THE BUSINESS MEN AT ELMIRA, N. Y., TO BE IN USE BEFORE CHRISTMAS HOLIDAYS.

ELMIRA, N. Y.

The Business Men's Association is actively engaged in securing a sufficient appropriation from the merchants to establish a permanent lighting system in the business section to use during the holidays and on all other occasions when special illumination is desired. The illustration shows the style of lighting fixture that will be installed.

YONKERS, N. Y.

Emulating the example of their Main street and New Main street neighbors, merchants of Palisade avenue met last night and organized an association, the primary object of which is to install and maintain a private lighting system upon Palisade avenue, between Getty square and the foot of Elm street.—*Herald.*

SIOUX CITY, IOWA.

The East Side Improvement Association is working to install an ornamental lighting system in its section similar to that already in use in the western section of the city.

OMAHA, NEB.

The Municipal Affairs Committee of the Commercial Club expects to appeal to the next Legislature for a charter amendment so that lighting districts may be established by law.

"It is generally conceded," says the committee, "that the first expense of standards and installation should be borne by the property owners or business houses benefited, after which the city should bear the cost of maintenance, for the reason that the whole city will benefit by the improved condition.—*Bee.*

NIAGARA FALLS, N. Y.

The permanent lighting of the Falls is now practically sure. The local business men have secured practically enough funds which, added to the $40,000 pledged by the railroad company, insure the desired installation.

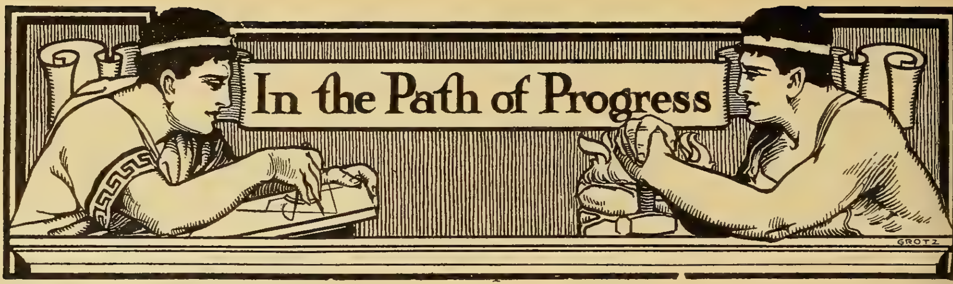
OTHER CITIES IN LINE.

Ornamental lighting systems are to be extended in the following cities: Peoria, Ill.; El Paso, Tex.; Austin, Tex.; San Diego, Cal.; Portland, Ore.; Dallas, Tex.; St. Paul, Minn.; Rochester, N. Y.; Rock Island, Ill.; Freeport, Ill.; Elgin, Ill.; Ft. Worth, Tex.

THE NEW LIGHTING IN PHILADELPHIA GETS A JOLT

Following Mayor Reyburn's declaration on Wednesday that the ease with which injunctions can be obtained and the abuse of the procedure were responsible for delays in the city's progress, another halt in contemplated improvement, due to the same cause, was brought to light yesterday.

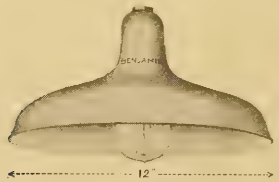
"I expected it," he said. "It is only another case of an irritating delay in the improvements contemplated by the administration. I have said that Philadelphia is fifty years behind what she ought to be because of these things. You can do nothing but wait until long, tedious investigations are made. These generally prove that the things and conditions investigated are really directly opposite to the charges. When this is found you can go ahead and begin to do that which would have been finished if the misguided citizen with the ever-ready injunction had not interfered with the progress."—*Inquirer.*



A Combined Reflector and Socket for Outdoor Use

The importance of reflectors in the utilization of artificial light is so great that some one has facetiously defined illuminating engineering as "the science of reflectors." There are many factors to be considered in the design or the selection of a reflector for a given purpose. For outdoor use durability and ease of cleaning perhaps stand first in the list, although efficiency is of course by no means to be neglected. These three prime requisites are combined to an exceptional degree in a new device put out by the Benjamin Electric Manufacturing Company, Chicago, which they call "reflector sockets." These are of steel, enameled white on both sides, and presenting a particularly artistic as well as businesslike appearance. They are thus described in a bulletin recently issued on the subject:

Reflector sockets consist of a deeply-hooded one-piece enameled steel reflector, with a threaded bushing and strap tightly clamping the reflector between two leather washers, and a specially designed receptacle or socket. The reflectors furnished are of two general types: (1) Flat cone (distributing), for wide distribution; (2) bowl-shaped (diffusing), for medium distribution. The hooded portion varies in depth to accommodate three kinds of lamps: (1) Carbon and short base; (2) skirted base; (3) large base. Reflectors suitable for any intended distribution may thus be obtained.



THE BENJAMIN REFLECTOR SOCKET, WITH 12-IN. REFLECTOR.

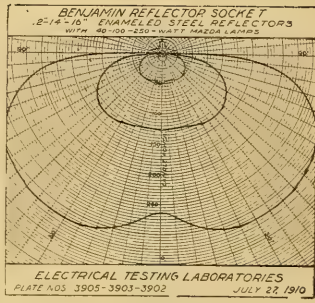


FIG. 2.—PHOTOMETRIC DISTRIBUTION CURVE OF 12-IN., 14-IN. AND 16-IN. REFLECTORS, WITH 40-100-250-WATT MAZDA LAMPS.

Each is designed for use with a definite range of lamps, and with particular regard for the correct relation of lamp filament and reflecting surface.

"Luceo" Reflectors

Under this trade name the Jefferson Glass Company, of Follansbee, W. Va., have just put out a line of reflectors made of their new material, which they call Onyx glass. This glass, while having a milky white appearance, must not be confused with the familiar "opal." It is much more translucent, has a waxy softness of surface instead of the high gloss of ordinary glass, and closely resembles,

LUCEO BOWL TYPE REFLECTOR.

both by transmitted and reflected light, the purest specimens of Mexican onyx. A series of reflectors of the bowl and flared types are shown. The glass is distinguished by having a remarkably small coefficient of absorption and in giving no brilliantly illuminated spot, like frosted or opal glass. The glass has great possibilities for decorative illuminating purposes, aside from its use in the form of reflectors, and much is to be expected from glass of this character in the future.

"Reflexolier"

This is the title of a booklet just issued by the Welsbach Company, Gloucester, N. J., and gives illustrations and descriptions of their line of chandeliers fitted with reflex burners and pilot ignition systems, to which they have given the trade name Reflexolier. The line is a generally attractive one, embracing both commercial and artistic designs. The booklet is unique among fixture catalogues in giving a brief description of each fixture from the artistic as well as the mechanical side, the description being intended to serve as a guide in selecting the most suitable fixture to correspond to a given style of architecture or decoration. The statement often heard recently that gas fixtures, in point of artistic merit, have not kept pace with electric lighting fixtures is successfully contradicted by this booklet.

A New Form of Steel Reflector

As reflectors of this type are preferred for certain purposes, particularly in industrial lighting, engineering data concerning any particular form is of direct practical value to illuminating engineers. The following data concerning the improved forms of Holophane steel reflectors, which has been kindly furnished us by Mr. E. B. Rowe, of the Engineering Department of the Holophane Co., Newark, Ohio, will therefore be of special interest:

We will consider the comparison of the old and the re-designed line under three headings.

First, Efficiency. An analysis of the photometric curves on the old and re-designed reflectors shows an average increase of 31 per cent. in the total lumens in the 0 to 60° zone. The increase is practically the same for the E and I types, being 33 per cent. for

THE NEW EXTENSIVE TYPE HOLOPHANE D'OLIER REFLECTOR.

the Extensive and 29 per cent. for the Intensive. Taken by sizes, the increase is: 25.9 per cent. for the 40 watt size, 38.5 per cent. for the 60 watt size and 28.9 per cent. for the 100 watt size. The total absorption is decreased by the 6.9 per cent. actual decrease—not per cent. of the old per cent. absorption, the latter (*i.e.*, not the old per cent. absorption, but the decrease in absorption expressed in per cent. of the old per cent. absorption) is about 19—this being distributed as follows: E type, 8.6 per cent.; I type, 5.2 per cent.; 40 watt size, 11 per cent., in the 60° to 90° zone is much less in the case of the re-designed reflectors owing to lower angle of cut-off and increased efficiency.

This increased efficiency is result of two improvements: first, and principally, because the reflectors are more scientifically designed, the change in contour in some cases being considerable. The second reason is because a special quality of steel is employed in the manufacture of the reflectors, which allows us to obtain a better finish and a more highly reflecting interior surface.

The second point of variation in the re-designed line is its closer approach to the ideal photometric curves required for uniform illumination. The Extensive types fol-

THE NEW INTENSIVE TYPE HOLOPHANE D'OLIER REFLECTOR.

low very closely the curve derived for a spacing constant of 2½ ($\frac{d}{h}$) where single lights are considered; *i.e.,* the E types, will illuminate a circular area having a diameter 2½ times the height of the light-unit above the plane illuminated, the illumination being uniform over one-half of the area and then dropping off gradually, as per Mr. A. J. Sweet's assumptions in the derivation of the ideal curve. This curve conforms closely to a constant of 2 for distributed unit spacing, *i.e.,* these Extensive steel reflectors when used in the form of squares or rectangles should be a distance apart equal to twice their mounting height, which is the same spacing requirements as for the Extensive glass reflectors.

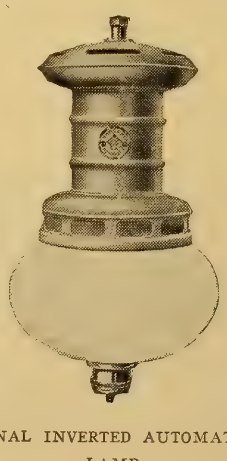
In the same way, the re-designed Intensive steel reflector gives a distribution which is very close to the ideal curve, having a constant of 1½ for a single light; *i.e.,* the area illuminated by one unit considered independently as a local light, has a diameter of 1½ times the mounting height, the illumination being uniform over one-half or more of the area and then dropping off gradually as in case of the Extensive. The new Intensive distribution is also very close to the group spacing constant of 1¼, so that, like the glass Intensive type, these should be spaced distance apart equal to 1¼ times their mounting height for uniform illumination, with outlets arranged in squares or rectangles. The re-designed units, therefore, are susceptible to exact spacings with the same certainty of obtaining uniform illumination, as in the case with the high efficiency and standard line glass reflectors.

The third point to be emphasized is one which exists in the old line, viz.: a low angle of cut-off of the light emitted from the bottom of the reflector. While the old reflectors have been considerably better than any other types of metal reflectors on the market from the standpoint of glare elimination, we have succeeded in lowering considerably the angle of cut-off in the new reflectors, which angle is between 70 and 75° from the vertical. This complete concealment of the light-unit is obviously a distinct advantage where clear lamps are used, as is generally desirable in industrial work where the steel reflectors have their greatest application. By using clear lamps, then, we obtain the maximum flux of light from the lamp itself, and the improved design of the new reflectors utilizes this most efficiently by throwing down below 60° the maximum flux of light and still obtaining a distribution curve following closely the ideal distribution for certain predetermined mounting and spacing conditions.

A Practical Inverted Gas Arc

The inverted mantle gas burner is one of the numerous improvements in lighting devices that has come to us from Germany within the past decade. Burners of this description were successfully used in Europe some time before they were commercially introduced into this country, which was doubtless due to the general use of higher pressures and more uniform regulation in gas supply abroad than has heretofore maintained in this country. It was found necessary, therefore, in order to adapt the inverted burner to American conditions, to provide for a greater variety of pressures and qualities of gas than had been done by the inventors. Naturally these problems were first worked out for individual lamps; but the popularity of the so-called "gas arc" is so great that efforts to utilize the advantages of the inverted burner followed close in the wake of its general introduction.

Among the several gas arc lamps using inverted mantles that have achieved success the lamp known as the "National," from the name of its manufacturers, the National Gas Light Company, of Kalamazoo, Mich., and Springfield, Mass., apparently has excellent claims to practical merit. The chief feature of this arc is an automatic regulator to take care of varying pressures, thus meeting the most serious obstacle to the success of this type of lamp in America. It is claimed that this device provides a uniform flow and volume of gas under widely different pressures, and so enables the lamp to give full efficiency under all ordinary conditions, without carbonizing at low pres-



THE NATIONAL INVERTED AUTOMATIC GAS ARC LAMP.

sures or "popping" at high pressures.

Added to this feature is a careful mechanical design, with all the essential parts outside the casing where they can be easily reached, and substantial workmanship throughout.

The claims for the several points of special merit are apparently fully sustained by those who have given the lamp a thorough and impartial trial. The "National" should certainly be included in any general test of lamps of this type made as a basis for purchase or use.

The Annual Gas Show of the National Commercial Gas Association

At the time this issue reaches the hands of our readers the annual Gas Show will be in full swing in Mechanics' Hall, Boston, December 7 to 13. From every indication—and the indications include signs that are unmistakable—the show will not only be a success, but will far exceed in special and general interest any previous exhibition of the gas industry. The hall selected is not only ample, but well adapted to exhibition purposes, and all of the committees have been most assiduous in their efforts to make the total result a memorable one. A full report of the exhibition will appear in our next issue.

Announcements

Mr. Francisco Laurent Godinez has resigned his position as lecturer for the engineering department of the Holophane Company, Newark, Ohio, and accepted a position with the Central Station Development Company, of Cleveland.

We had occasion some months ago to refer to the exceptional work which Mr. Godinez was then doing in the way of popular lectures on the subject of illumination. While these public lectures were necessarily more or less spectacular, and hence attracted public notice, they were by no means the most important part of Mr. Godinez's work. Following the public lectures, he gave a most complete series of private lectures on illuminating engineering as applied to central station practice to the employees of the central stations in the towns in which he appeared. This is the first systematic attempt at giving comprehensive instruction to classes of students interested in the subject.

Mr. Godinez's thorough training in electrical engineering, his comprehensive experience in central station methods, as well as the practical application of illuminating engineering, peculiarly fitted him for this work. The idea of giving such courses originated with Mr. Godinez. His varied talents and recognized ability, both as an engineer and instructor, should make him an exceptionally valuable asset to the company with which he is now connected.

The Adams-Bagnall Electric Co., of Cleveland Ohio, has recently acquired by purchase the good-will and assets of the Jandus Electric Co., of the same city. The combined business will be conducted by the Adams-Bagnall Electric Co., which will continue to manufacture the products of the Jandus Company, which will be sold under the trade name of "Jandus." Both the commercial and engineering departments of the Jandus Company will be retained by the Adams-Bagnall Co. The consolidation should prove an advantage to the patrons of both companies.

The Moore Light Company, of Newark, N. J., has opened a demonstration and sales office at 500 Fifth avenue, New York City, where their various forms of vacuum tube lamps will be on exhibition.

A Correction

In the last issue of this magazine mention was made of a bulletin of the National Electric Lamp Association, stating that it dealt with "Mazda Series Lamps." The title should be "Mazda Multiple Lamps." Those wishing the bulletin will be guided by this correction.

PROCEEDINGS

Proceedings of Technical Societies

DISCUSSION

The Fourth Annual Convention of the Illuminating Engineering Society

The convention was opened in McCoy Hall, Johns Hopkins University, Baltimore, at 10.30 a.m., Monday, October 24.

An address of welcome to the city was given by Hon. J. Barry Mahool, Mayor. While most cordial in his greeting and expressions of welcome to the members and their guests, the Mayor had the good judgment to confine the serious part of his address to the setting forth of Baltimore's claims as a city of historic importance and present progressiveness, leaving matters of illuminating engineering for those versed in the subject. He made a distinctly favorable impression upon the audience as an official whose whole heart is in the work of promoting the welfare of the city of which he is Mayor.

The address of welcome to the university was delivered by the president, Dr. Ira Remsen, who spoke with his inimitable wit and humor of the work already accomplished by the university and its future hopes, and also of the field of usefulness for illuminating engineering. President Remsen has a rare faculty of combining wit and wisdom, and his addresses were the most sparkling features of the convention. His evident sincerity left no doubt as to the genuineness of the welcome of every one present to the university and its hospitality.

For his annual presidential address Dr. Hyde took the lofty subject, "The Goal of Illuminating Engineering." Throughout his discourse Dr. Hyde showed himself to be the highest type of scientific investigator and idealist, characteristics which have invariably impressed themselves upon those who have come in contact with him personally or through his numerous valuable writings. The ultimate goal of illuminating engineering is the perfect light perfectly applied—a goal which is manifestly beyond the reach of human imperfection, but toward which steady progress can be made. The perfect light would be one which would convert all of the energy supplied into visible radiations of such a quality as to produce white light. Efficiency he defined as "the ratio of satisfactoriness to cost and not merely the reciprocal of cost." The goal of illuminating engineering would not be attained by any mere computation of foot-candles and lumens, nor the design of lamps and reflectors which should give a predetermined distribution, but by the universal production of illumination, which is, in its ideal sense, efficient—that is, while meeting the requirements of physical efficiency—satisfies the physiological and esthetic senses as well. While the address was not wanting in valuable technical matter the high idealism of the speaker was manifest at every point.

REPORTS OF COMMITTEES.

Three committees were scheduled to report on the programme. Dr. C. H. Sharp presented a report for the sub-committee on Photometric Units, of the general committee on Nomenclature and Standards, of which Dr. Alexander C. Humphreys is chairman. The report contained definitions proposed for various photometric terms, but specifically stated that the list was not complete.

A report of progress on "Flame Standards," by Dr. E. B. Rosa and E. C. Crittenden, was presented by Dr. Rosa. The

report gave the result of a series of very careful investigations of the Hefner amyl-acetate and the Harcourt pentane lamps. The investigations were carried on at the Bureau of Standards. The report shows distinct progress in the improvement of these two primary standards.

The committee on the Division of Membership reported, through its chairman, Mr. E. L. Elliott, that the committee had not agreed upon any specific plan for such a division, and recommended that the matter be left for such action as the society may wish to take at some future time.

The following papers were presented at the three remaining sessions:

"Central Station Illuminating Engineering Department Work and Methods Applied by the Denver Gas & Electric Company," by C. F. Oehlmann.

Mr. Oehlmann describes briefly and very clearly the work of the illuminating engineering department of the Denver Gas & Electric Company. It will be remembered that this company was the first central station to take up illuminating engineering as an essential part of its business department, and though illuminating engineers were mostly in embryo at that time, the company secured as competent services as possible and gave *bona-fide* work in this new science rather than simply using the term as an advertisement or talking point. Mr. Oehlmann's paper should be carefully read by the business department of every central station and gas company. The following are some of the most interesting points brought out:

This department has an office where architects may come for information, contractors to estimate jobs and consumers to discuss store or residence lighting, for better and more satisfactory illumination. In this office are samples of the various kinds of lamps, both gas and electric, as well as burners, shades and reflectors. These lamps and shades are not connected for service, nor is it intended to make a demonstration of what any one lamp will do, but they are simply used to explain to consumers why lamps, shades, etc., are built as they are, to explain why a tungsten lamp must be handled carefully, why a gas mantle is to be protected from rough usage, why some reflectors are more efficient than others, why a shade is necessary at all, and also to explain a few processes of the manufacture of the various lighting instruments. Every one is interested; even explaining where the candle power is measured from on a 16-c.p. carbon lamp excites much interest, and nine out of ten consumers seem surprised that 16-candle-power does not mean 16-c.-p. end-on.

There are more severe criticism and grief from inconsistent fixture designing where some particular style of architectural design has been adhered to than in any other work of the illuminating engineering department. It is known that there are three very decided purposes which characterize the three most distinct branches of the art of illumination, namely:

First. That of supplying light for carrying on such adventures or amusements as are extended into hours of semi or whole darkness. This branch includes interior illumination, such as store, residence, factories and shops.

Second. The art of scenic illumination directed for special effect and designed to produce special illusions. This branch includes stage lighting, picture and art galleries, etc.

Third. That used for what is called electrical advertising, impressive, attractive, establishing locations, etc. This branch includes window lighting, sign lighting, electrical lamp creations, such as growing flowers, illustrations of lightning, rain, fountains, etc.

Complaints. As was mentioned in an earlier part of this paper, 70 per cent. of the work of the central station illuminating engineering department is the settling of complaints of some kind or other, usually high bills. These complaints come from all departments of the company. When a complaint comes to the illuminating engineering department, the illuminating engineer tags it, "Hold the business." It is the complaining consumer that is the encouraging prospective consumer for the gasoline salesman. Not many gasoline lamps would be in service to-day if all gas or electric consumers had always been pleased with and enthusiastic over the results using either gas or electric light. The person complaining may be what is sometimes called a chronic kicker and by some departments considered incurable, but there are few chronic kickers in the Denver territory. The complaining person is one who usually complains about a high bill, or poor service, or both. The first step taken is to ascertain what amount the consumer has been paying during the past year. This information is marked on the complaint memorandum for future reference; the person who turned in the complaint for the consumer is then consulted and much useful information is thus obtained. A call is then made on the consumer by a member of the illuminating engineering department, who discusses with him the reasons for his complaint. He is offered the services of the illuminating engineering department free of cost. It is explained to him that if he accepts the services of the department his place of business will be measured and a drawing of his store for illustrating a suggestion or a new system of illumination will be made.

Usually in the case of so-called high bill, and often in the case of extremely poor lighting service, the store has been piped by a plumber of a gas fitter following a set of plans drafted by an architect. The average architect thinks the lighting feature of his work is of no importance. The lighting arrangement is left until the last. After drawings are almost complete, after all painting has been specified, all decorations decided upon, all ventilation arranged, all store fixtures arranged, he picks up a pencil, and says: "We will put an opening here, one there, one there," etc. He does not contemplate the illumination when deciding colors and styles of decoration, nor ventilation; he does not calculate illumination at all, but just puts in lamp openings. It is often found that the consumer's lighting system is at present just as good as it has ever been, but owing to the fact that his neighbors have improved their systems his installation seems to have deteriorated. Frequently no difficulty is experienced in holding the business, even when the complaint is based on a high bill, for the improved lamps often make it possible to give a consumer twice and even three times the illumination he had obtained previously.

When the consumer consents to have the illuminating engineering department measure his store and make suggestions for better illumination, a drawing is made showing all of the walls, windows, doors, hallways, show windows, etc. Then if the consumer contemplates any changes in the rooms or building a note is made of them, and often they are arranged for on the drawings if the changes are to be made immediately. In case there is sufficient time the openings for the lamps are so arranged that when the building is changed the proper system will be in readiness. The openings that are made in contemplation of changes are plugged and no fixtures are installed. The fixtures are specially designed or selected and specifications are drawn. The drawings and specifications are submitted to the consumer and, if the plans are accepted, bids are asked on the work and taken to the consumer, and the contractor is thus selected. The work of installation is superintended by the illuminating engineering department until completed and accepted by the consumer. When the new lighting system is placed in operation the central station reaps the harvest of the work of the illuminating engineering department. No matter how bitter he may have been in his complaints, almost invariably a consumer will become very much enthused over the improved appearance of his store; he can then easily be induced to step outside of his store and compare the outside with the improved interior. He does not wait to be coaxed, but usually says, "What can we do about those windows and that sign?" It is not the actual amount of money the consumer pays that interests him, but how much he gets for his money. When the illuminating engineering department by a rearrangement or a new system gives him three times as much illumination as before, the consumer is glad to pay the bill; the illuminating engineering department has held the business, and the consumer becomes immediately a prospective consumer for better window lighting and sign advertising.

"The Effect of Light on the Movement of Lower Organisms," by Prof. Samuel O. Mast.

This title as it appeared on the programme was not particularly attractive, especially to the practical illuminating engineer, but the address given by the professor proved to be the most fascinating in its peculiar interest of all the discussions presented. The interest, of course, was due largely to the masterly manner of presentation of the speaker. He described the effect of light upon certain micro-organisms, which revealed wonders that those unacquainted with the mysteries of biology have never dreamed of; and although the astonishing facts brought out have no apparent relation to illuminating engineering, the wrapped attention of every one present—and the lecture room was crowded to its full capacity—was evidence of the genuine interest of the address.

Illuminating Engineering Sheets for the Calculation and Recording of Data, by J. S. Codman.

The author states that the sheets are designed to have three functions:

First. To serve as a convenient means of recording the results of photometric tests.

Second. To facilitate the making of calculations from the test data recorded, and

Third. To serve as a convenient record of such calculations, so that repetition of work done will, to a great extent, be avoided.

Two forms are given, one which he calls the "angle sheet" and the other the "distance sheet." The sheets are ruled in columns, with headings specifying the data to be recorded. The author claims for these the following desirable features:

First. They can be readily filled out piecemeal at convenient times, the work being taken up exactly where left off because all work previously done is permanently recorded.

Second. Since the sheets contain all the necessary constants they can be filled out without reference to tables or books of any kind.

Third. At any stage of the proceedings additional copies of the data and calculations can be obtained by the simple process of blue printing.

Some Neglected Considerations Pertaining to Street Illumination, by Preston S. Millar.

This paper is a further elaboration of a paper on the same subject recently presented before the New York Section. The points brought out by the writer are both new and important. Judged solely by its practical value to illuminating engineering, this paper was probably the most important one presented in the convention programme. Street lighting is the question uppermost at the present time in the general field of illumination, and any successful attempt at solving the many unsettled questions which have hitherto confronted the engineer in such cases is especially to be welcomed.

The conclusions as given by the writer fairly sum up the paper:

To recapitulate, it is to be noted that objects in streets at night are discerned most usually as silhouettes against a lighted background. The first requirement of good street lighting is for a well lighted street surface to serve as a background. It is the effective brightness of street surface, or the brightness as seen when viewing the street longitudinally at an angle or 2 to 3 degrees, which determines the value of the surface as a lighted background. The effective brightness may be increased by providing a greater number of more powerful lamps or by repaving the street with material having more favorable light reflecting qualities. The light distribution characteristics of all commercial illuminants being unsuitable for street lighting, it would appear feasible to increase the effective brightness of streets by directing a larger proportion of the light upon the street surface. With a given intensity of incident light the effective brightness of a street is greatest when the lamps are mounted over the driveway. Non-uniformity of illumination, while undesirable, is not so objectionable as has been asserted, because (1) the effective brightness of street surface does not vary as much as does the intensity of incident light, and (2) the bright street surfaces near lamps assist in discernment of large objects in the dimly lighted regions.

Glare must not be neglected. Its effect becomes harmful when the glaring source is very near (less than 5 degrees removed from) the object to be seen or when there is no lighted background against which to view objects. In ordinary city installations the glare from street lamps may dazzle temporarily after one looks directly at the lamps, and may increase the chance of failure to perceive a barely perceptible object in a hasty, careless glance. But otherwise it occasions no material decrease in ability to see objects. It is entirely feasible to design a lighting installation in which there shall be entire absence of objectionable glare while securing high effective brightness of street surface. But usually in practice one must choose between decreased effective brightness of street on the one hand and some degree of glare on the other. For each such installation there is some compromise which will produce the best results. The proper compromise can be reached best not as a matter of theory or prejudgment, but as a matter of trial in the street, preferably including a determination of ability to see under the various conditions.

The problem of street illumination is not simple when considered alone as a matter of theory. The additional elements which commercial conditions introduce render it extremely complicated in practice. A number of the factors which enter into the problem might be studied independently with profit. But the application of the results of such studies must always be made with due regard to the importance of other factors. Our tenets of street illumination must be broad-gauged and must give proper weight to all elements of the subject, whether scientific or commercial.

Relations Between Pressure and Light Output with Various Gas Lamps and Burners, by Norman Macbeth.

This is probably the most complete investigation of the subject that has yet been published. Tables, diagrams and photographs are given which furnish very complete data upon the subject investigated, and will be of lasting value to illuminating engineers having to deal with gas as an illuminant.

Some Spectral Luminosity Curves Obtained by Flicker and Equality Brightness Photometers, by Dr. Herbert E. Ives.

The difficulties of measuring intensities of lights of different colors has been one of the stumbling blocks to the photometrist since measurement of light became an important science. Dr. Ives' paper reports careful experiments to compare the results obtained with the two principal forms of photometer used for such purposes. His conclusions are as follows:

Spectral luminosity curves obtained by several observers using the flicker and equality-of-brightness methods do not show exact agreement between the two methods. With different observers the relative positions of the two kinds of curves are different. At

low illuminations the equality-of-brightness curves shift toward the blue, the flicker toward the red. Marked differences in the color sensibility of the five observers exist, as shown by each method. The flicker method possesses much greater sensibility than the equality-of-brightness method, the difference being greatest at high illuminations.

The most important fact shown by this investigation is probably that the flicker method and the equality-of-brightness method give nearer the same values at high than at low illuminations.

The Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light-Sources, by J. G. Feltman and E. J. Brady.

This appears to have been the first careful investigation of this subject. A considerable amount of the paper is taken up with a description of the apparatus and methods of procedure. The results are then given in the form of curves plotted in the same way as the ordinary light distribution curves. While the results are theoretically interesting, their application to practical illuminating engineering does not appear to be of great importance.

The Value of Illuminating Engineering to the Commercial Man, by William J. Serrill.

The writer makes a plain and forceful plea for the use of illuminating engineering by those handling the commercial side of the lighting field. His concluding paragraph is particularly significant:

> The profession of illuminating engineering deals with an important subject, fraught with grave consequences to the future of our race. Conserving the most vital one of those five senses which form the connecting links between the personality of the individual and the physical world, it is destined to exercise an important influence on the progress of civilization. It enlists the services of the physicist, the chemist, the mathematician, the physiologist, the oculist, the manufacturer, the architect, the artist; and in this list the commercial man holds an honorable and commanding position. No one, two or three of the types of men here named can solve the multifarious problems of the profession. It requires the services and the co-operation of them all. The profession cannot afford to have any one of them hold aloof; and it will prosper in proportion to the degree of co-operation and of interchange of opinion that is maintained, and to the extent to which those individuals who compose each group endeavor to broaden their views by obtaining as great a knowledge as possible of the activities of the other groups. The commercial man cannot afford to remain ignorant of the progress of illuminating engineering. The best basis upon which to build the knowledge and experience of salesmanship in this commodity is a familiarity with the principles of illuminating engineering.

The Practical Value of Illuminating Engineering to the Central Station, by John F. Gilchrist.

The subject of this paper is so self-evident as to make any argument seem superfluous. The writer has presented the case briefly and forcefully. Concluding, he makes the following important suggestions:

> A splendid advance has been made in the course of lectures which has been arranged to follow the convention of the society, and undoubtedly a large number will take advantage of the opportunity offered, but unfortunately whatever this number is, it will be relatively small when the whole number of men in the business is taken into consideration. The society should consider some means of extending these benefits to a very much greater number of men engaged in the practical work of selling illumination than could possibly be gathered together at any one place. Results could possibly be accomplished by giving this form of instruction from several centers, or better yet, some correspondence arrangement, with examinations, etc., might be arranged which would insure the proper amount of individual work on the part of students.
>
> With the proper stirring up, there should be no difficulty in providing the necessary funds for such courses of instructions, because, from the standpoint of the central station, there is no more practical work in the industry than that being done by the Illuminating Engineering Society.

The Value of Illuminating Engineering to the Manufacturer, by V. R. Lansingh.

Mr. Lansingh treats the subject briefly, dealing specifically with the manufacturers of artificial illuminants, of shades and reflectors, of appliances used with artificial lighting, and of contributing apparatus.

At the conclusion of the presentation of papers the formal opening of the lecture course took place, the opening address being given by President Remsen, who was followed by Dr. Hyde. Short ad-

dresses were then made by Mr. Herbert A. Wagner, representing the Association of Edison Illuminating Companies; Mr. W. W. Freeman, representing the National Electric Light Association; Mr. W. C. Morris, representing the American Gas Institute; Dr. J. D. Whitehead, representing the American Institute of Electrical Engineers; Dr. Samuel Theobald, representing the American Ophthalmological Society; Dr. Wendell Reber, representing the Academy of Ophthalmology and Oto-Laryngology, and Mr. J. R. Sloan, representing the Association of Railway Electrical Engineers.

The speakers were limited to five-minuate addresses and all expressed a deep interest in the rise and progress of illuminating engineering.

Vacuum Tube Lighting, by D. McFarlan Moore; a paper read before the Franklin Institute, September 21.

In this paper Mr. Moore gives a general review of the work which he has been doing on this form of lighting for the past sixteen years.

Sign and Window Lighting, by E. W. Osborn; a paper read before the annual convention of the Illinois State Electric Association, Rock Island, October 25.

The paper is a presentation of the advantages of this class of lighting to the merchant and its value as a source of income to the central station. The writer is advertising manager for the Rockford Electric Company and speaks from experience as well as theory.

The Illuminating Engineering Society

The November meeting of the New England Section was held in the Edison Building on the 14th. The evening was devoted to a discussion of schoolroom lighting, the subject being opened by Mr. B. B. Hatch of the Boston School Commission. Mr. Hatch has probably given more attention to the illuminating engineering problems presented by public schools than any other school official in the United States, and the results of his work show in the lighting of the Boston public schools. He laid particular stress upon the value which the society could be in drawing public attention to the abuses in this class of lighting, and also gave many valuable points resulting from his own experience.

Mr. Hatch stated that

"the general tendency of illuminating engineers and the technical press is to treat the classroom as a problem involving nothing more than placing a few light-sources in a room to give practically even illumination, with the object of satisfying the greatest number of persons. Nothing could be further from the truth than this conception of the elementary simplicity of the problem. The first step is to get an even distribution of light and a sufficient number of foot candles of illumination, but that is not all. One of the first difficulties of the Boston School Department was the question of color, its effect on the individual, and the relation of furnishings and trimmings on the light itself."

"More children come to school with their eyes injured by improper home lighting conditions, particularly at the study table, than are hurt by improper lighting in the school itself. The school authorities naturally have no control over home lighting conditions, and the greater part of the eyesight injury occurs at the pupil's residence, in many cases. He touched upon the difficulties of providing proper illumination in the twilight period."

Dr. Louis Bell, Dr. C. H. Williams and others took part in a discussion which followed.

The October meeting of the Philadelphia Section was held on the 21st, at which a paper on the "Co-efficient of Diffuse Reflection" was presented by Mr. F. H. Gilpin. The paper reported the results of an investigation to determine the amount of diffused reflection from different surfaces at different angles of incidence. This is the most complete investigation of this subject that has yet been made and the results are therefore a distinct addition to the literature of illuminating engineering.

The October meeting of the Chicago Section was held in the Great Northern Hotel on the evening of the 13th. After an announcement of the general programme of the year by the chairman, Mr. F. J. Pearson, a paper on "Good Lighting from a Factory Viewpoint" was presented by Mr. Joseph Newman, Jr. The writer is an engineer with the International Harvester Company and has given the subject special study. He discussed the various phases of the subject, and referred

particularly to the necessity of good lighting to protect workmen against industrial accidents.

The speaker contended that the reflector is the factor upon which the success or failure of factory lighting depends. Porcelain enamel finish is the only one which has proved itself sufficiently durable, and the intensive distribution of light is the form which finds the largest use. Reflectors are most efficient with the larger sizes of lamps.

In concluding Mr. Newman declared that the factory wants a lighting system at a minimum first cost, even at the sacrifice of some efficiency. It wants a system which will give twenty-four-hour service, with a minimum of unskilled attention. It wants a unit which will fit naturally into the divisions of shop space made by the post-supported mill construction. It wants a large percentage of the light concentrated on the machines and work, but enough general illumination in all parts of the shop to make movements as safe as under daylight conditions.

American Institute of Electrical Engineers, Cleveland, O.

The regular meeting of the Cleveland section of the American Institute of Electrical Engineers was held November 17. The session was devoted to a discussion of "Lamps and Illumination."

Mr. G. S. Merrill reviewed his paper on "Tungsten Filament Lamps," which he presented before the Toronto section and which appeared in the September Transactions of the A. I. E. E. This paper was a technical study of the tungsten filament and of the reasons for its high efficiency. Mr. M. D. Cooper discussed the stresses which exist in filaments when lamps are burned in a horizontal position and also described the methods of deriving equations for accurately calculating the performance of various types of filaments.

Mr. J. G. Henninger gave a brief résumé of the various uses to which "Mazda" lamps are now adapted, showing that there is almost no field of illumination which has not felt the effect of the high efficiency lamps.

The importance of providing proper light in industrial work was touched upon by Mr. Ward Harrison. The insignificant cost of such lighting, when compared with the value of the workman's time, was brought out. The proper method of calculating comparative costs of lighting was also discussed, and the necessity of considering the items of depreciation and maintenance and the efficiency of utilization was particularly emphasized.

The Moore Light

A lecture on this subject was given by Mr. D. McFarland Moore, the inventor, before the Baltimore section of the American Institute of Electric Engineers on the evening of October 28. The lecture was delivered in the Johns Hopkins University Physical Laboratory.

Luminous and Flaming Arcs Versus Open and Carbon Arcs for Street Illumination

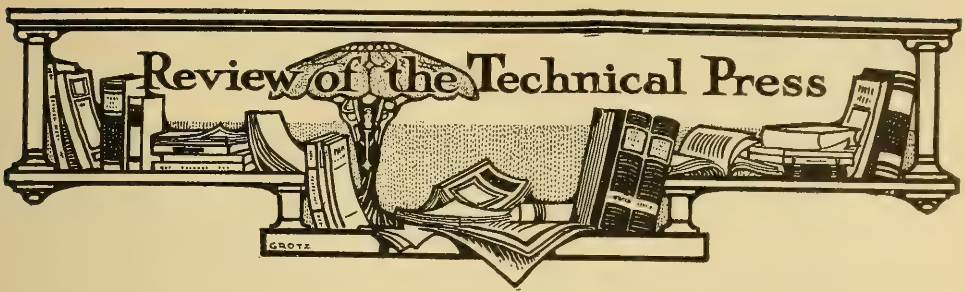
By W. d'A. Ryan.

Read before the National Electric Lamp Association Convention, St. Louis, May 23.

Owing to the very elaborate charts, which are the chief features of Mr. Ryan's paper, its publication was necessarily delayed. A very handsome reprint by the General Electric Company has recently been issued.

This is the most complete as well as the most impressive analysis of the relative values of the different arc lamps now in general use for street illumination that has ever been published. Mr. Ryan, by right of the extent of his experience in street illumination, both in time and amount, may be justly considered the Dean of illuminating engineering in this field. In this paper every available diagramatic method has been used to show the relative performance of the different arc lamps, and every test commonly applied in illuminating engineering utilized. The half-tone illustrations of some of the best known installations of magnetite and flaming arcs are equally impressive to those unaccustomed to reading curves. As maintenance varies with local conditions, no attempt is made to give any figures in regard to this item. The flaming arc is, of course, conspicuous for its lead in luminous efficiency from every point of view, the luminous, or magnetite arc being a fairly good second. In practical use, of course, maintenance costs will change the relation of these two light-sources somewhat.

Mr. Ryan's paper adds another to the many valuable contributions to the science of illuminating engineering contributed by this authority.



American Items

New Books

Electrische Beleuchtung von Dr. Ing. Berth—old Monasch Oberingerteur zweite ergaenzte Auflage mit 112 Abbildungen Hannover, Dr. Max Jaenke, Verlagsbuchhandlung, 1910.

When the first edition of the just designated book appeared (in the year 1906) illuminating engineering just started on its most brilliant career. Blondel's system of arc lighting—described on the pages of this journal—produced an epoch in modern street illumination. The electrolitic (oxidic) and metallic arcs appeared on the market. The metallic filaments revolutionized the incandescent lamp industry. These new sources of artificial light in a comparatively brief period of time attained a high state of perfection and acted as a stimulant on the old methods of light production. The progress in the art of measuring light kept pace with the rapid advance of illuminating engineering in general. New, ingenious and practical photometers were designed. New, ingenious and practical methods of measuring and calculating luminous values were worked out. Steps were taken on the road of international agreements concerning the exact meaning of various terms, symbols and units in use in the art and science of illumination. The physiological and psychological aspect of illumination was taken into consideration.

The revision and supplement of the old edition of the book up to date we have now before us. The volume is divided into two distinct parts. The first part comprises eight chapters, dealing with the science and art of measuring light in all its ramification; arc and incandescent lamps; the arrangements of lamps in the circuit and their installation; radiation and effectivity of various sources of light and illumination in general.

The second part of the book is designed to give a concise account of the progress in illuminating engineering during the years 1906-1910.

The supplement is in its turn divided into three chapters. The first chapter is devoted to photometry, the second to arc light and the last to incandescent lamps.

Nothing of technical importance in the fields indicated is omitted. There is an abundance of illustrations, curves and tables well calculated to enrich and elucidate the text. The data are all either original or verified by the author.

We only regret that the entire volume is not rearranged and rewritten so as to represent an organic whole. The treatment of the same subjects in two separate parts of the book dealing with the state of the science and art of illumination, one before 1906 and the other after that year up to our present year, is, to say the least, confusing to the reader.

We miss also a due consideration of the chemical aspect of illumination and it sources.

And yet the volume before us has to be classed among the best contributions to the literature of illuminating engineering. No technical library worthy of its name can be considered complete without this book.

Isidor Ladoff.

THE APPLICATION OF ARC LAMPS TO PRACTICAL PURPOSES, by Justus Eck, M.A., M.I.E.E. 101 pp. Illustrated. Cloth. S. Rantell & Co., Ltd., 36 Maiden lane, Strand, London, W. C., England. Price, 2s. 6d. net.

The purpose of the book is thus stated by the author:

This little book is not intended to cover either research into the nature and possibilities or the mathematical theory of illumination, but is intended as a help and guide to the large number of persons who have now in some form or other to deal with the arc lamp.

An endeavor has been made to give as far as possible information of a simple, practical kind that will be of assistance both to the reader, when dealing with arc lamps and arc lighting, and to the industry generally in securing a better appreciation of that beautiful piece of electro mechanicism, the modern arc lamp.

While written to meet English conditions, the larger part of the book is devoted to descriptions of the newer types of arc lamps and to a general discussion of arc lighting, which applies to one country as well as another. It is profusely illustrated with diagrams and half-tones, and the style is particularly clear and free from unnecessary technicalities. It is a book that will meet the requirements of a large number of illuminating engineers, central station attendants and others who wish the maximum of practical information with a minimum of technicalities.

New Publications

PRACTICAL ELECTRICITY AND ENGINEERING. Published monthly by Practical Electricity Publishing Company, Chicago. Vol. I, No. 1, bears the date November, 1910.

The front cover states that the publication is "A magazine for the operating engineer and electrician." The first issue contains 66 pages and cover, the latter being printed in two colors. If the future issues of the magazine can be judged by what the first number contains it will certainly establish a new record in technical journalism. The articles are all carefully prepared, well illustrated and upon subjects that are of importance to the field which it proposes to reach. The subscription price is only $1 a year. We cannot help but admire the optimism which has produced this most excellent first number of a new journal in a field that is already overcrowded. If it can maintain the standard which it has set for a sufficiently long time to convince subscribers or possible subscribers that it can continue indefinitely, the publication cannot help but succeed.

ILLUMINATION OF THE DENVER ELECTRIC SHOW, by Joseph A. McMeel; *Electrical World*, October 27.

Describes the first annual electric show of the Colorado Electric Club, which took place in Denver from October 8 to 15. The article is illustrated with interior and exterior views showing the illumination.

THE LIGHT OF THE FIRE-FLY; *Electrical World*, October 27.

This is the subject of two very interesting letters, one by Elihu Thompson and the other by W. W. Coblentz. Both letters deal particularly with the recently published articles by Ives and Coblentz, and give the very latest word in this interesting theoretical subject.

NEW SYSTEM OF LIGHTING FOR ATLANTIC CITY'S BOARDWALK; *Electrical World*, November 10.

An illustrated article describing the several methods proposed for the lighting of this famous promenade, a number of prominent manufacturers of lamp-posts having put up specimen installations.

EFFECTS OF THE FORM OF ELECTROMOTIVE FORCE WAVES UPON THE LIFE AND EFFICIENCY OF INCANDESCENT LAMPS, by Charles S. Kinslow. Bulletin published by the Engineering Experiment Station of the Pennsylvania State College.

A report of tests made to determine the effect upon the four different types of filaments at present used in incandescent lamps of the form of A. C. wave of EMF. The results show that the life is materially greater on all forms with the sine wave than with the peaked wave.

WIRING AND ILLUMINATING CHART, by H. D. Austin; *Electrical World*, November 24.

This is another one of several graphic methods of determining the various photometric quantities which enter into problems of illumination. The chart given can also be used for determining size of wire required for a given amount of current. While the method seems to be an entirely practical one, its advantages over other charts, or the Macbeth Calculator, is not readily apparent.

MEXICO'S CENTENNIAL ILLUMINATION, by W. D. Hornaday; *Electrical Review and Western Electrician*, November 12.

A short illustrated article describing the main features of the illumination, with figures as to the number of lamps used for various features.

THE BEST LIGHTED BUILDING IN THE WORLD, by Joseph A. McMeel; *Electrical Review and Western Electrician*, November 26.

A very brief description of the exterior and interior illumination of the new office building of the Denver Gas & Electric Company.

SHOULD GAS ARCS BE RENTED OR SOLD? by George W. Thompson; *Progressive Age*, November 1.

A short discussion of this apparently endless question. The writer takes the side of renting.

ANOTHER GAS WHITE WAY, by C. W. Wardell; *Progressive Age*, November 15.

A short illustrated article describing gas arcs on Kensington avenue, Philadelphia.

GAS ARC LIGHTING, by L. E. Spear; *Progressive Age*, November 15.

Gives some interesting facts and figures regarding the use of gas arcs in Chicago.

LIGHTING'S LAST MONUMENT, by Charles E. Walker; *Progressive Age*, November 15.

The writer sets forth the economies of the gas arc, mentioning a particular make. This fact detracts much from the article, giving it the unmistakable flavor of an advertising write-up.

A DEMONSTRATION TALK ON GAS ARC LIGHTING AND ITS ADVANTAGES, by J. J. Peemiller; *Progressive Age*, November 15.

A discussion of the subject in the dialogue form. A supposed customer is given various arguments in favor of this form of lighting.

GAS ARC LIGHTING, by R. W. Reed; *Progressive Age*, November 15.

Gives experience with this form of lighting of the gas company in Lansing, Mich. Details of installations are given, with illustrations.

MAINTENANCE OF GAS ARC LAMPS, by S. P. Stewart; *Progressive Age*, November 15.

A very brief discussion of the subject, giving experience in Pittsburgh, Pa.

PLACING THE GAS ARC LAMP, by E. A. Samuels; *Progressive Age*, November 15.

Deals with the commercial proposition of obtaining customers for this form of lighting.

All the foregoing articles are in the prize competition series which has been open in this journal for some time.

OUTDOOR LIGHTING IN ENGLAND, by Norton H. Humphreys; *American Gas Light Journal*, November 14.

This is the third installment of a series of articles by this writer. The fourth section appears in the issue of November 21.

THE ILLUMINATION OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS' BUILDING, by Roscoe Scott; *Building Management*, November.

An illustrated article describing the illumination of this fine new office building, which is located in Cleveland. Tungsten lamps are used throughout.

THE PLUMBER AND THE LIGHTING TRADE; *Domestic Engineering*, November 19.

The writer says that " scientific knowl-

edge of the lighting business is almost an absolute necessity in these days of progress." The article is an able argument along these lines.

A New Method of Measuring the Effect of Light Upon Dyes and Pigments, by Jacques Boyer; *Scientific American,* November 5.

A very interesting illustrated article describing the methods used by the French color expert, Mr. P. Dosne, to express by numerical quantities the amount of fading produced by a given amount of solar radiation.

Studies in Mathematical Optics, by Prof. Charles Sheard; *Optical Journal and Review,* November 17.

Under this heading a series of articles is being given treating of the more elementary principles of mathematical optics.

Experiments in Proving Optical Laws, by Howard D. Minchin; *The Optical Journal and Review,* November 17.

This is another series of articles on the general subject of theoretical optics. Both of these courses are well written and illustrated with diagrams.

Relation of Vision to the Pupil's Mental Status, by John Louis Beard; *The Educator.*

An article calling attention to the evil effects of eye-strain due to defective vision upon the moral and mental character of school children.

Studies in Luminescence.—XII. The Absorption of Alcoholic Solutions of Eosin and Resorufin.

XIII. The Specific Exciting Power of the Different Wave of Lights of the Visible Spectrum in the Case of the Fluorescence of Eosin and Resorufin, by Edward L. Nichols and Ernest Merritt; *Physical Review,* October.

The articles are illustrated and strictly technical, as the titles indicate.

Notes on Electric Lighting, by Caryl D. Haskins; *General Electric Review.*

Under this topic Mr. Haskins, who is the manager of the lighting department of the General Electric Company, is writing a series of articles dealing principally with the electric side of the question.

Quality of Light, by Paul F. Bauder; *Scientific American.*

A fairly comprehensive discussion of the conditions which constitute quality in illumination.

Street Lighting in Chicago.

This subject is dealt with in a report conducted by the W. H. Zimmerman Company, constructing engineers, for the Commission on City Expenditures, which is investigating the conduct of the various municipal departments. Contains much useful information, especially in the way of statistics as to cost of maintenance, etc.

Editorials

Electrical World:

Illumination and the Eye, October 20.

More About the Fire-fly, October 27.

Surface and Street Lighting, October 27.

Illuminating Engineering Society Convention and Lectures, November 3.

Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light-Sources, November 3.

Illuminating Engineering Lecture and Laboratory Course, November 3.

Voltage Wave Distortion and the Life of Incandescent Lamps, November 17.

Electrical Review and Western Electrician:

Illuminating Engineering, October 22.

Glare, November 5.

Flame Standards and Photometry, November 5.

Lamp Efficiency and Temperature, November 26.

Outline Lighting, November 26.

Railway Electrical Engineer:

Illuminating Engineering.

Pavements and Illumination; *Engineering Record,* November 5.

The Newer Electric Lamps; *Scientific American,* November 5.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

SURFACE BRIGHTNESS AND A NEW INSTRUMENT FOR ITS MEASUREMENT, by J. S. Dow and V. H. Mackinney; paper read before the Optical Society, London, October 13; *Electrician*, October 28, etc.

A paper dealing with the brightness of various surfaces and the measurement thereof. The authors point out that in many cases it is not so much the illumination as the actual brightness of the surface studied that is the most exact portrayal of practical conditions. For example, in a room it is really the apparent brightness of the wall or of the illuminated page of a book that we wish to know. Examples are given of the measurement of the brightness of illuminated placards, the illumination in trains and tramcars, etc. The authors describe a new and very portable instrument for making tests of this kind, termed "The Lumeter"; by using a standard white screen it can also be applied to determine illumination.

ILLUMINATION, ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter; Continued; *Illum. Eng.*, London, October.

The author completes his remarks on "Errors in Photometry." Curves are presented, showing how the sensitiveness of the eye falls with decreased illumination of the surface studied, and reference is made to the color difficulty and other troubles.

BEITRAG ZUR WIRTSCHAFTLICHEN VERTEILUNG DER LICHTQUELLEN, by W. Wittek; *Elek. u. Masch.*, October 9.

Discusses the question of the best theoretical relations between the distance apart and height of street lamps, so that a given horizontal illumination may be secured at a minimum cost. It is pointed out, however, that the relation determined is affected by other practical considerations and subject to modification.

THOMAS YOUNG ORATION BEFORE THE OPTICAL SOCIETY, LONDON, by R. W. Wood; *Electrician*, October 7.

Contains a description of several novel optical devices, including echelette gratings for studying infra red rays and a new form of telescope, involving the use of a rotating dish of mercury.

IMPROVEMENTS IN SCHOOL LIGHTING; *Illum. Eng.*, London, October.

Comments upon the recent report of the medical officer of the London County Council. One matter commented upon is the need for the proper direction of light; badly placed lamps lead to constrained attitudes on the part of school children and the possibility of spinal curvature, etc.

GLARE AND LIGHTING; *The Times*, Eng. Supplement, September 28; *G. W.*, October 8.

This article in *The Times* Engineering Supplement is a remarkable illustration of the interest taken in illumination even in the less technical papers. The article summarizes the chief practical conclusions at present arrived at regarding the avoidance of glare. It is also pointed out that nevertheless a shadowless and entirely uniform illumination is rarely desirable. We want contrast—but *agreeable contrast*. Anything excessive tends toward the impression of glare.

SECOND INTERNATIONAL CONGRESS DES MALADIES PROFESSIONELLES; *Illum. Eng.*, London, October; *The Times*, September 29.

This congress was referred to in the last review.* It need now only be pointed out that this is another indication of the interest in illumination that *The Times* should give so much attention to the subject.

L'ECLAIRAGE DES SIGNAUX DES TRAINS

* ILLUMINATING ENGINEER, November, p

et des Voies Ferrées; *Rev. des Eclairages,* October 15.

This article refers to the action of M. Millerand in advocating, on behalf of the French Government, the use of brighter lamps for railway signal lighting. It is rather curious to notice that in the United States recent investigations showed a tendency to use undesirably bright lights, which were troublesome to the eyes of engine drivers.

The Lighting of the City of London; *Illum. Eng.,* London, October.

L'Eclairage en Chine; *Rev. des Eclairages,* October 15.

Electric Lighting

The Street Lighting of Dowlais, by L. W. Dixon; *Electrician,* October 21; *Elec. Engineering,* October 27.

Describes the street lighting installation at Dowlais in Great Britain. Though only on a small scale, it is interesting as one of the few overhead installations of this kind in use in this country.

Die Langbrennende Flammenbogenlampe der A. E. G., by W. Hechler; *E. T. Z.,* September 22.

A new effort to deal with the problem of securing an enclosed and long burning flame arc lamp. In this case the fumes are allowed to deposit on a certain portion of the inner globe, forming a semi-opaque coating. But the temperature of the globe is such that a portion near the arc itself is too hot for deposition to occur, and the glass in this neighborhood remains clear. Consequently it is only the remote lower part of the globe that is affected, and the polar curve is only slightly altered as a result. A specific consumption of 0.34 watts per H. K. is said to be obtained.

A Three-Phase Arc, with Four Carbons, by A. Righi; *Electrician,* October 7, translation.

This arc uses one neutral carbon and three others connected to the respective phases. As a result, a very steady arc in which fluctuations are not noticeable even at very low frequencies is said to be obtained.

The Price of Electricity; *Elec. Rev.,* September 23; *Electrician,* October 14.

Comments upon the fact that the decreased revenue following the introduction of metallic filament lamps has led several electric supply companies to raise their prices.

High Power Incandescent Lamp Fittings; *Elec. Rev.,* October 7.

Electricity or Gas in Manchester; *Electrician,* October 7.

Electric Lighting of Shops and Windows; *Elec. Engineering,* October 20.

Neuere Bogenlampen; *Z. f. B.,* October 10 and 20.

Gas, Oil, Acetylene Lighting

Automatically Lighting Street Lamps; *J. G. L.,* October 4.

An excellent summary of the various methods of automatically controlling street lamps by rise in pressure, clockwork, etc., and their various advantages and disadvantages.

Lighting Efficiency at Low Pressure; *J. G. L.,* October 11.

Spectroscopic Observations of Acetylene, by J. W. Gatehouse; *Acetylene,* September.

Ueber die Beurteilung der Leuchtkraft Nach Ihrem Heizwert, by W. Mayer; *J. f. G.,* October 8.

The Westminster New Public Lighting Contract; *J. G. L.,* September 27.

Economical Aspect of Street Lamp Ignition and Extinction by Pressure; *J. G. L.,* September 27.

Ueber Festigkeitsprufungsen von Gasgluhkorpern; *Z. f. B.,* October 20.

Contractions used:

Elek. u. Masch. Elektrotechnik und Maschinenbau.
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World
Illum. Eng. Lond. Illuminating Engineer (London).
J. G. L. Journal of Gaslighting.
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
Z. f. B. Zeitschrift für Beleuchtungswesen.

The
Illuminating Engineer

Vol. V JANUARY, 1911 No. 11

THE ULTIMATE OBJECT

Every human action and impulse has for its ultimate object the direct good of the individual and the general benefit of mankind; all other actions are IN-human. These two objects are complementary and inseparable. It is impossible to achieve one without, in some measure, accomplishing the other.

Happiness, which is the measure of ultimate good, like light, radiates from its source in all directions and is reflected by every one upon whom its radiations fall. The good that men do is NOT interred with their bones, and it is the evil that perishes in the end.

Science is a search for the ultimate truth and its application to the needs of man. The truth cannot possibly work evil or harm.

Illuminating engineering is a page in the great volume of science. It is a part of the universal truth of nature. Its ultimate purpose is the benefit of mankind. It cannot be destroyed. Like the mirage, its truths may be shown inverted, or in a false position, and so lead to error and evil, but the thing itself remains unchanged as a force for good. It may be thrown among evil associates, and personated for selfish purposes, but still its own ultimate purpose is unchanged and beneficent.

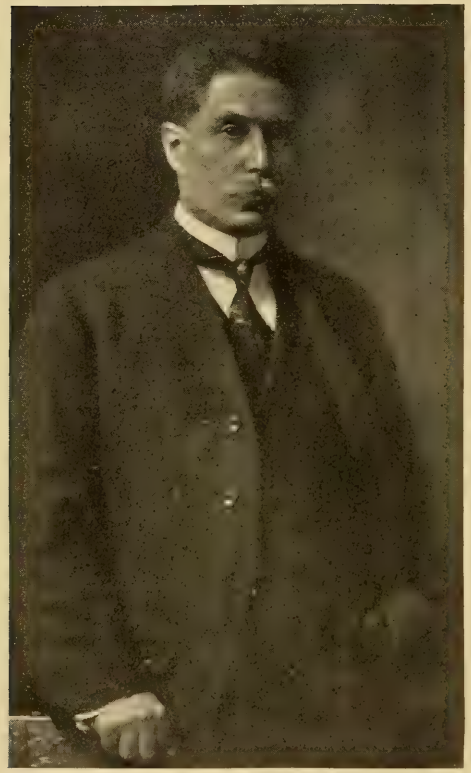
Light is the primal blessing of nature, which made man possible. It is an ultimate good in itself, and all effort directed toward the better utilization of its immeasurable possibilities for adding to the sum total of human happiness can but lead to the same ultimate object.

Let there be more and better light.

E. L. Elliott.

A National Campaign for the Conservation of Vision

Organization of a National Association for Carrying on the Work



DR. F. PARK LEWIS.

On Saturday, December 17, in the trustees' room of the Russell Sage Foundation, Fourth avenue and Twenty-second street, New York, an event took place which is destined to have a world-wide influence in the field of illumination. This meeting was a conference of the several committees and organizations which have come into existence through various channels, having for their ultimate object the conservation of vision. The final result of this meeting was the adoption of a resolution providing for the appointment of a committee of seven to perfect an organization for "the prevention of blindness and the conservation of vision." While the exact name of the association to be formed was not decided, it is probable that it will be known as the American Association for the Conservation of Vision. This committee will be appointed by the chairman of the conference, Dr. F. Park Lewis of Buffalo, and will immediately take active measures to consummate the object for which it is created.

This association is the joining of several streams which had their origin in widely different parts of the general field of illumination and vision.

In the fall of 1896 the first public lecture dealing with the use of artificial light as an engineering problem was given by Mr. E. L. Elliott in several of the largest cities of New York State under the auspices of a local scientific society. The substance of this lecture was published serially in the *Electrical Engineer* in February, 1897. In this published report Mr. Elliott speaks of the "lighting engineer—a person who, we hope, will actually exist some day." This was the starting point of the special scientific study of the use of artificial light which ultimately led to the establishment of illuminating engineering as a separate science and profession. The prophecy, which seemed like a dream of the distant future when first made, was fulfilled with unexpected promptness.

At the same time, but approaching the subject independently and from an entirely different viewpoint, Dr. F. Park Lewis, a prominent ophthamologist of Buffalo, began to study the subject of illumination on the physiological side, and contributed an article on "Artificial Light in Its Effect on the Eyes" to the November, 1897, issue of the *Homeopathic Eye, Ear and Throat Journal.*

From this general consideration of the subject Dr. Lewis directed his efforts more particularly to the subject of the prevention of blindness, and by his unceasing efforts in this field succeeded in bringing the

matter to the active attention of the various medical associations, both State and National, and in arousing such a degree of public interest as to pave the way for effective legislation. In all his work Dr. Lewis has shown the most skillful generalship, which is no less admirable for the positive results obtained than for the impersonal and unselfish manner in which he has conducted the campaign.

Laying the Foundation.

When the cry of "On to Paris" first arose in Prussia Von Moltke laid upon the Emperor's table a plan for the campaign worked out to the utmost detail. The result is history. When the public had become sufficiently interested in the subject of preventing blindness and conserving the vision of those in possession of their ocular powers, to assure the success of an organized campaign for this purpose, it was found that Dr. Lewis had already laid the plans and secured the necessary lieutenants to make a general mobilization of forces a sure and quick success. Through his initiative a number of active and representative committees were already either actually working or in active preparation for work as follows:

The call for the conference was the direct result of an earlier conference on the matter of the prevention of blindness, which was held in February, 1908. The various committees and associations represented were as follows:

The (National) Committee on the Prevention of Blindness of the Russell Sage Foundation. The work of this committee has been largely instrumental in securing the appointment of other committees and the establishment of associations for this same object.

The Committee on Prevention of Blindness of the New York Association for the Blind.

The Maryland, Kentucky and Missouri State Associations for the Prevention of Blindness.

The American Association for Labor Legislation (New York Branch).

The National Educational Association Committee on the Conservation of Vision. The personnel of this committee represents all of the different elements of the problem, consisting of an ophthalmologist, a superintendent of schools, a text-book publisher, a professor of psychology and an illuminating engineer.

A Successful Conference.

The recent meeting was a conference of these various committees, together with a number of invited guests, who were interested in the general purposes of the meeting. Two sessions were held, which were devoted chiefly to an oral presentation of the work already accomplished, and future plans of the several committees. The most noteworthy feature of the meeting was the remarkable spirit of earnestness and enthusiasm which prevailed. Many of those present had traveled considerable distances and absented themselves from important personal duties in order to attend.

The organization, when consummated, will be practically a federation of active working committees investigating special problems and reporting their findings at an annual meeting, which will be held in different cities from year to year. One of the definite purposes as expressed in the call for the conference is to secure an international conference in 1912, thus foreshadowing the world-wide scope of the work. Beside the actual working committees, which will necessarily be kept manageably small, it is expected that there will be a large general membership, composed of those desirous of receiving information in some one or more of the special lines, or in contributing to the various investigations and efforts of the committees.

Relation of Movement to Illuminating Engineering.

This association, as will be seen from the general outline given, is the natural ally of the illuminating engineering movement. It represents what may be called the "ultimate object" of illuminating engineering—the conservation of vision. From the engineering standpoint the use of light is a physical and economical problem. To determine by scientific methods the kind and location of light units necessary to produce a given physical result of illumination, with the least expenditure for installation and maintenance, is unquestionably an engineering proposition. To determine the effect of this illumina-

tion upon the organs of vision directly, and indirectly upon the general physical health, mental activity and psychological condition of those working under it, is quite another problem, and one in which the illuminating engineer acting in his special capacity will never be able to solve. There has been a general assumption on the part of the illuminating engineering fraternity that when the engineering problem has been solved, when the requisite intensity of light on some theoretical surface has been provided economically, the whole question is settled. This is not only a mistake, but if carried out to a finality would prove to be a fatal fallacy. Illuminating engineering is an important and definitely prescribed branch of applied science, but in itself it does not represent a complete result. The conservation of vision is the logical and necessary complement of illuminating engineering.

In another sense, the association will include illuminating engineering as an essential and important element of a broader and more beneficent purpose. Illuminating engineering which does not in the end conserve human vision would better never have been born. To illuminate a given room or space at a less money cost than before, but at the expense of eyesight, is not economy, but criminal parsimony. Illuminating engineering is essentially commercial and material: the conservation of vision is humanitarian, and economical of human rather than material resources. The immense field of active usefulness which this new association proposes to cover is impossible to conceive at the first glance. Some idea of its extent can be gathered from a consideration of a few of the special problems to which it will give its immediate attention.

The Prevention of Blindness.

The very word blindness produces an involuntary shudder. The blind have always been special objects of human sympathy, pity and care. To restore the sight has been considered an action worthy of Divinity itself. Perhaps it is because we have had the blind with us from time immemorial that we have been heedless of the causes.

It is a startling piece of information to the average lay mind to learn that at least one-fourth of all blindness is absolutely unnecessary, being preventable by means now well understood. Furthermore, a considerable of the remaining portion could either be prevented entirely or greatly mitigated by the application of the proper scientific measures. This represents the extreme wing of the activities of this new association, and has the least direct connection with illuminating engineering, although by no means entirely foreign to the subject. A very appreciable percentage of the cases of total blindness are due to accidental causes, which could have been prevented by proper illumination, while the neglect to follow some of the more important principles of the science may readily result in partial or total destruction of vision. The subject is one which is plainly capable of legislative regulation.

Conserving the Vision of Children.

The right of the State to insist upon a certain degree of education of the rising generation, which in due course must become the body politic, is now generally recognized and put into legal execution. This means that for a considerable portion of the life of the majority of children the State practically takes bodily possession of the child. By so doing it becomes responsible for its physical as well as its moral and intellectual welfare. Malpractice in any of these three principles is, therefore, a public crime. While little criticism can be made of the moral atmossphere and training in the public schools and no serious objection made to the development of the mental faculties, in the care and cultivation of the physical body there is frequently a degree of carelessness that amounts to criminal negligence. Vision, the most precious and important of all the senses, has received only desultory attention. Stereopticon views shown at the conference and the descriptions of conditions given by one of the best known woman principals of the New York City schools reveal conditions of abuse of the eyes of school children that are so appalling as to be scarcely credible. In the public schools of this city there are more than fifty schoolrooms in which artificial light has to be continuously used, and the light provided, at least in a large proportion of

them, is of a kind that would disgrace the meanest tenement in the slums, and is totally unfit for continued use by any human being for any purpose, to say nothing of the close eye work of study by the sensitive eyes of children. There are occasional examinations of school children's eyes, but they are unsystematic and inconclusive.

The whole subject of vision of pupils, including the physiological condition of their eyes on the one hand and the quality of the light furnished on the other, is one in which there is the most urgent need of careful investigation and public agitation for better methods and greater care. Thus far, while this fact has been more or less recognized among those coming into direct contact with the subject, it has been a case of "what is everybody's business is nobody's business," and so the deplorable conditions have been allowed to continue for want of knowledge and active efforts towards their amelioration. The committee investigating this subject is a thoroughly representative one, and its labors will continue until definite and conclusive results have been obtained. When this is accomplished a foundation will be laid for the general regulation of the subject through State legislation.

Industrial Lighting.

The progress of civilization has lead to a constantly increasing use of artificial light and a proportionately increased strain upon the eyes. It is a curious fact that of all conditions tending to conserve and promote the efficiency of the human machine those affecting the one organ upon which all the others depend should have been the last to receive attention. The use of light in the industries is of the highest importance from both the humanitarian and economical standpoints. There is no question of doubt as to the far-reaching effect of eye-strain upon the human system, but thus far this is only a deductive generalization; just how and to what extent this is true remains to be discovered.

One of the most significent incidents in the recent annals of union labor is the demand of the striking female garment makers of this city for better hygienic conditions in their work-rooms, one of their chief complaints being that they were compelled to work by insufficient illumination. As a result of this demand a full investigation of conditions prevailing in this industry is to be made by authority of the Department of Labor of the State, and the question of illumination will receive adequate attention.

In most of the States there are laws, many of them of recent enactment, regulating the various hygienic conditions under which wage earners work. In none of these is there any consideration of this most important item of artificial lighting. There cannot be the slightest doubt that this facility is as amenable to legal regulation as any other hygienic condition. An initial effort in this direction was made by The Illuminating Engineer a year ago. This new association now becomes the logical source of action in such matters, and a committee to consider the subject of industrial lighting in all its phases will undoubtedly be appointed at an early date.

Education of the Public on the Conservation of Vision.

Every effort in a humanitarian direction must include as one of its very important, if not the very most important of its activities, a propaganda of public education. This fact was forcibly expressed by Dr. Woods of Baltimore, speaking at the conference, who said in substance that all efforts to determine ways and means of conserving vision were well in their place, but the final question is, how to have these acted upon by the people. Public education does not differ in principle from private education. "Line upon line, precept upon precept;" "keeping everlastingly at it"—these express the one chief means. Every possible avenue of approach to the public mind must be used to the fullest legitimate extent.

It is in carrying out this general campaign of public education that this association can perhaps serve its most useful function. With branches, committees and workers in every nook and corner of the country and with the ample resources which unquestionably will be available when once it has shown practical evidence of its usefulness, it will have access to all the most valuable avenues and by-ways through which the public may be reached.

Street Illumination in Germany

By R. F. Pierce.

The pre-eminence of Germany in all that pertains to illumination is so generally acknowledged that ideas from German practice are, or at least should be, welcome to every progressive illuminating engineer. In street lighting, especially, Germany has far outstripped America; in fact, there is scarcely a single street in the United States to-day that could be called even fairly well lighted, according to German standards.

Various explanations are offered as to the obvious inferiority of America in this respect, but few of them are at all satisfying. It is contended by some that the greater density of population in Germany permits a greater expenditure per mile for street lighting purposes. This will hardly hold water, however, as many well-lighted German cities spend less per mile of street than American cities, which are undeniably poorly lighted. Another equally misleading explanation is the low cost of carbons and labor in Germany, which permits high efficiency arc lamps (that is, the short burning flaming arcs, burning expensive carbons and requiring trimming every day), to be run at a reasonable cost. This is not borne out, however, by a comparison of the cost per unit for operating such lamps abroad and at home.

One of the leading American central station companies has embodied in its contract with the city a price of substantially $156 per year for flaming arc lamps of the short burning type. This price was undoubtedly determined upon after sufficient and adequate tests, and applies to any future requirements that the city may have for lamps of this type. It may be assumed that it yields a satisfactory profit to the central station. The same company obtained about $100 for ordinary inclosed arcs.

FIG. I.—BERLINERSTRASSE, CHARLOTTENBURG.

FIG. 2.—COLOGNE.

No accurate figures are available regarding the cost of similar units in Germany, and, in fact, none exist, as the inclosed arc lamp on account of its extremely low efficiency and unpleasant light, is not tolerated in that country. In England, however, where the flaming arc lamp enjoys an extensive vogue for commercial street lighting, and inclosed arcs are still used to a certain extent, the latter cost $60 per year, where the flame arc costs $125, thus the flaming arc costs less compared to the inclosed arc in America than in Europe, where the flame arc has obtained its strongest hold.

It is worth noting here that the luminous arc, produced from electrodes containing oxide of iron, chromium, etc., has never received serious consideration in Europe. Arcs produced from iron compounds have certain therapeutic uses, mainly for the extirpation of cancerous growths, but have never been adopted for street lighting.

The rapidly increasing commercial use of the flaming arc lamp in America is the best evidence of its adaptability to American conditions. It has been found reliable and economical in widely diverse industrial fields, and in so far as street lighting is a business proposition it must sooner or later be done by flame arc lamps unless an entirely new and unforeseen development takes place. There can be no serious doubt that the business interests in American cities are quite willing to pay for illumination by flaming arc lamps.

The greatest barrier to the development of flame arc street lighting in America is the fact that existing contracts between municipalities and central stations do not provide for the installation of lamps of this character. Whenever the merchants in any particular business district wish to illuminate their streets to a really adequate degree it necessitates a number of separate contracts with the central station or the concerted action of a business men's association, both of which have many disadvantages from a practical standpoint. The execution of separate contracts makes it impossible to secure the uniformity that is absolutely necessary for a really good street lighting installation. In case the Merchant's Association, as a whole, executes the contract with the central station, means must be taken to insure the responsibility of the association in a manner satisfactory to the central station, all of which demands more harmony and un-

animity of thought and action than usually prevails with a number of business men, among whom a large amount of competition exists.

In America at present street lighting is anything but a business proposition. The commercial needs of the municipality are rarely, if ever, considered intelligently. In fact, in many States such onerous and altogether ridiculous regulative legislation has been imposed on the central stations that it is practically impossible for anything in the way of improvements in street lighting to take place without special legislative enactment. For instance, where the revenue that the central station may derive is set at a fixed price per lamp regardless of the nature of the unit, it is obvious that unless the flaming arc lamp or other high efficiency illuminants be specifically provided for their use is practically prohibited by statute. To any one, however, who is familiar with the progress that the flaming arc lamp has made and the fact that its present vogue in America is due entirely to its economy, it is evident that it must, sooner or later, displace all units of lower efficiency for street lighting in those districts where really effective illumination is required.

The same considerations which prompted the abandonment of the carbon filament incandescent lamp in favor of the inclosed arc lamp exist, and to a greater degree, in comparing the present metallic filament incandescent lamps and inclosed arc lamps with the flaming arc, and the development is sure to be along the line of the high efficiency unit.

A glance at the accompanying cuts will first of all impress one with the fact that German street lighting systems are not so radically different from American ones as to make parallel comparisons either difficult or misleading. All the illustrations are made from photographs of street lighting installations in which vertical carbon flame arc lamps, consuming 550 watts and producing a pure white light, are used. The writer considers that only installations giving practically a daylight color of light are useful, as far as application to American conditions are concerned, as it is the settled policy of most American cities to use only pure white light for street illumination, and as this policy is well grounded

FIG. 3.—CHARLOTTENBURG.

FIG. 4.—TIERGARTEN, BERLIN.

in theory and has proven thoroughly satisfactory in practice, it is improbable that any deviation will be made from it.

Fig. 1 shows a typical installation of these lamps installed in a manner quite prevalent in Germany, and all things considered probably the ideal one for street illumination. The lamps are suspended from cross wires attached to tall poles on opposite sides of the street, the lamps being suspended from a cut-out hanger in the middle of the street. This method locates the lamp in the best possible position for securing effective and uniform illumination, but has the disadvantage that two poles per lamp are required and in congested business districts fire departments would probably take exception to the installation of the cross wires. These lamps are spaced about 150 ft. apart and it will thus be seen that the kilowatts consumed per mile are substantially the same as that required for what would be called good business street lighting in America. The intensity of illumination secured is, however, six or eight times as much as would be produced by the same energy in inclosed arc lamps or tungsten lamps.

The illustration shown on the front cover shows a public square lighted by five lamps on tall poles. The almost daylight intensity of the illumination on both the streets and buildings fronting the square is clearly shown, and will be more appreciated by considering the fact that the photographic reproduction of lighting effects by night always fall far short of the actual result produced.

Another and better instance of the same character of lighting which exhibits the same effect is shown in Fig. 2. The distinctness of the smallest details in the mosaic work on the left of the photograph shows plainly that the intensity of the illumination is far above that of any similar installation with which Americans are familiar.

Fig. 3 is an excellent example of the manner in which the architectural beauties of public buildings may be brought out at night in a manner that permits their enjoyment as fully as in the daytime. When it is considered that these architectural effects are achieved only with the expenditure of an immense amount of money, and are, so far as their real purpose is concerned, non-existent after the hours of daylight, the actual economy in dollars and cents of providing illumination that will extend the effectiveness of these architectural features during the hours of darkness is at once apparent.

If it has been considered good policy to expend, say, half a million dollars in embodying in a public building such artistic features as will benefit the municipality as a whole, it is certainly equally good economy to expend two or three dollars per night in order that the effect of these features upon the public may be increased by a period of time equal to 40 or 50 per cent.

A use of the flame arc lamp which cannot fail to appeal to the architect, is shown in Fig. 4. The same considerations which exist regarding public buildings extend to an even greater extent to decorative statuary, placed in prominent public squares, parks, etc. The provision of illumination, whereby works of art which have been installed purely for their esthetic value, can-

not fail to increase that pride in the municipality and sense of civic responsibility which after all is the prime consideration in all the activities of the municipality.

High Candle-Power Tungsten Units for Office Lighting

By Frederick A. Watkins

From the illuminating engineering standpoint the recent installation of large candle-power incandescent units in the new general offices of the Scully Steel & Iron Company at Ashland avenue and Twenty-fourth street, Chicago, is of considerable interest.

Before the advent of the tungsten filament, lamp manufacturers made little or no attempt to make incandescent lamps of high candle-power and voltage; and even now they are entering this field with some misgivings, especially the American manufacturers. The German makers, however, have not feared to make incandescent lamps of large candle-power and large wattage running up even to 1000 watts, and have quite successfully met the requirements of this form of lamp manufacture.

The lamp which, however, is finding a most important place and filling a long-felt want for general illumination of offices, large stores and factories is a 450-watt tungsten lamp. This lamp gives 400 c.-p. at 450 watts, and has a remarkable average life of 1500 hours, while their maximum life runs up as high as 3000 to 4000 hours; this, too, with a maintenance of high efficiency to the end of their life.

FIG. 1.—HIGH EFFICIENCY TUNGSTEN UNITS ALBA BALL GLOBES IN OFFICES OF SCULLY STEEL & IRON COMPANY, CHICAGO.

It is an installation of these lamps that I wish to describe to my readers.

The problem it was sought to solve in this installation was the lighting of a large general office, equipped for clerical work with the usual flat top desks, files and stenographers' desks, where it was important to give good lighting without the usual unsightly individual drop lights. The floor space to be lighted was divided by low railings into different departments and offices. In the center of the office is a skylight of dome construction, and this, together with high and large side windows, gives ideal lighting during the day hours when the sunlight is good and strong.

For the solution of the problem it was decided to use single units of high candle-power, spaced so as to give a uniform distribution of sufficient candle-power, to insure a good illumination for working purposes and the 450-watt 400-c.-p. tungsten lamp furnished this unit. This lamp combined the highest efficiency, longest life and the greatest economy, and gave a unit of maximum decorative and illuminating effect. There are installed (24) 450-watt 400-c.-p. tungsten lamps in four rows, in which eight of the lamps came underneath the dome skylight. The lamps are placed at the centers of the bays, each lamp being wired from an individual switch on a switch panel box controlling the lighting system of the entire office. This gives an extremely flexible system in which, when the daylight illumination from the dome was sufficient for that portion of the office, the lights around the edge of the room where it was dark could be lighted without burning those under the dome, where they were not needed, or any bay could be lighted by its individual lamp without burning any except the lamps actually needed. Each lamp is hung from a simple drop fixture, consisting of the usual canopy, from which drops a chain supporting the lamp and its shade. The finish of this fixture is brush brass, and the chain is 4 ft. long.

Alba globes, which completely inclosed the lamps, were used, the shade being made in (2) hemispheres of ribbed construction and held together by means of an equatorial brass band. The complete inclosure of the lamp in the globe made it unnecessary to frost the lamps and at the same time obviated any glare which the unfrosted lamps would naturally give. The Alba globes gave a soft diffused effect of efficient and perfect illumination for decorative, as well as working purposes.

The lights were installed on a circuit of 110 volts. The ceiling of the room being white, the complete reflection of the light downward is obtained, giving on the entire floor a uniform light distribution free from all shadows. The accompanying photograph will give a general idea of the features of this installation.

It is apparent that a great advance has been made in illuminating engineering and in incandescent lamp manufacture in particular, where it is possible to light so completely and conveniently a large office of this sort with single incandescent units of high candle-power.

The Development of the Moore Light

By D. McFarlan Moore.

Throughout the entire field of artificial illumination the advances of recent years have resulted in new forms of lights that more nearly approach natural light than heretofore. This tendency is logical and also gratifying to those who had to endure severe criticism for advancing this theory a dozen and more years ago. We were told that a sunlight or daylight effect at night time was unnatural—but not so to-day. The human eye has become most suitable for daylight through ages of evolution, and its small use at night has been a negligible factor in this process. The end of improvements in artificial light will not be reached until all the attributes of natural light are reproducible and demanded and universally used at night.

A few years ago even experts stated that the public's desire for light was satiated, but we have seen, for example, in a decade the intensity of the average foot-candles of show windows and streets increase tenfold. In many of our large cities it is now possible to read newspapers in street cars for blocks without the aid of the lamps within the cars, but by depending solely on the general street illumination.

Just as average intensity has so remarkably approached daylight values, so also has diffusion, but to imitate it still further, resort will need be made to long tubes. Daylight is cheap, but no longer procurable in unlimited quantities in our congested centers. Many new forms of light have made great strides in the direction of improved efficiency, but both theory and practice point unmistakably to the vacuum tube as the road to further advance.

It also claims superiority in the ability to imitate natural light as regards safety and steadiness and softness, but there is still another factor that is growing of more and more importance every day, and is being considered to a much greater degree—viz., color. For the higher and still higher refinements of our system of illumination, the demand will not cease until light of perfect color values becomes a positive necessity everywhere—except for the few special uses where abnormal light is desired. But the rule will still hold that the more nearly a light's spectrum approaches natural light the more suitable and less injurious it will be to the human eye and *vice versa.*

There is only one way known of producing directly a spectrum accurately resembling average diffused daylight—viz., by passing an electric current through pure carbon dioxide gas in a vacuum tube. An indisputable amount of evidence is available and thoroughly proves this statement that is both scientific and commercial, and which extends over a number of years of rigorous investigation both in this country and abroad. The scope of this paper will permit of reference to but one authority—viz., the official report of the United States Bureau of Standards, which stated that the white Moore light is the same as that obtained by averaging various daylight conditions. But the use of carbon dioxide gas for the production of commercial electric light is impracticable unless it is replenished by the use of the Moore automagnetic feed valve, one of the most important factors of the Moore light system of illumination.*

Any form of gas can be fed to this automatic valve, but when CO_2 is used and a suitable electric current applied, the pure white light resulting is now actually used scientifically and commercially to define just what daylight is. Daylight is the true standard, but is decidedly a variable: white CO_2, the secondary standard, is in absolute constant. Therefore, the world's best standard of colors for all purposes is the white Moore light.

In this respect it has no competitor. It is remarkable that the worlds of science and art and commerce have existed so many ages without a color standard and at the same time it is an extremely fortunate scientific coincidence that a perfectly satisfactory color standard is a producible in

* See "Light from Gaseous Conductors Within Glass Tubes—the Moore Light—A. I. E. E.—April 26, 1907."

FIG. I.—SECTION OF MOORE TUBE ILLUMINATION IN THE NEW YORK POST OFFICE.

so simple a manner. Its ultimate adoption by all scientific societies should be hastened.

The shortcomings of all other forms of light as regards color values are much greater than generally supposed. Ordinary incandescent lamps, as well as tungsten lamps, make a red color appear many shades too light, a green color appear decidedly a yellowish green and a blue color appear a dark purple; while yellows are changed to orange and lavenders to pink. The Nernst lamp is in the same class. The Welsbach gas light turns the reds darker and yellows to orange, while arc lamps make the reds, blue and yellows too light.

The color values of the so-called "intensified arc" lamps are improvements over those of the ordinary arc, but still fall very far short of giving satisfaction to any color expert, whether artist or artisan. In fact, the pursuance of a large number of occupations, after the sun has set on dark days, was absolutely impossible until the advent of the white Moore light. It is suitable for matching with extreme accuracy the most delicate shades of the primary colors: red, green and blue, or of orange or yellow or violet. Some of the other well-known forms of light will do fairly well for matching one or two of these colors, but none of them are at all practical for use with the six colors and their multitudinous shades. That is, for example, there are no practical dye-houses in the world operating at night save under the white Moore light, but of these the number is already great. Neither has there been a single instance where the hypercritical tendency of this trade has not been amply satisfied.

An examination of each of the floors of a large department store almost always discloses at least half a dozen locations when colored goods of one kind or another are on sale.

All except abnormal paintings are executed under daylight, and, therefore, their

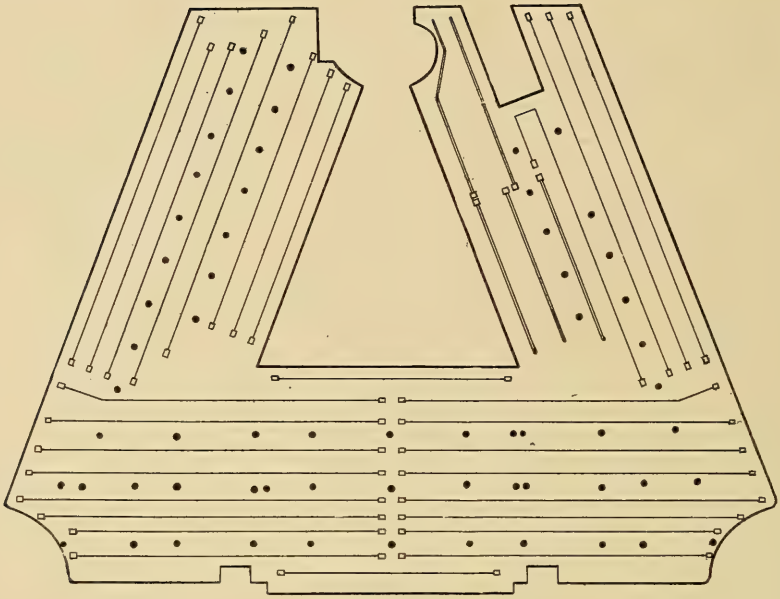


FIG. 2.—PLAN OF UNITS IN THE NEW YORK POST OFFICE INSTALLATION.

true spirit cannot be grasped or their values correctly judged unless viewed at night under the color equivalent of daylight.

The very large industrial paint trade needs true colors, from the manufacturer's laboratory to the decorating of metal cases for toilet articles.

The buying public is gradually demanding of the clothing store merchant that they be given some further assurance other than his word, whether the suit is blue or black if purchased late in the afternoon or at night.

Two diamonds will look alike under the ordinary electric light, but only under daylight and the Moore light, the one by its color may prove itself to be of twice as much value as the other.

The women purchasers in the silk and dress goods sections of the department stores have been long-suffering. They are weary of walking long distances carrying a piece of goods to a meager bit of daylight, or in returning an unsatisfactory purchase because it did not match under daylight. Under such conditions the merchant loses money not only due to dissatisfied customers but also due to the unnecessary amount of time which is required to make each sale.

The color distinction faculty of the great public in general is becoming more acute each day as the campaign or education advances. The dyeing avocation has a wide range from silks, cottons and woolens to feathers and leathers.

In photograph studios the subject can be better posed because all colors appear just as in daylight.

The largest dyeing establishments in the world now consider the white Moore light an absolute necessity to their business. It enables them to run on schedule time, which they could not do heretofore, and redyeing is done away with. The enormous importance of color is exemplified in the fact that textiles are claimed to be the world's greatest industry; yet its values are largely dependent on color.

No form of inflamed tissue, whether in the throat or intestines during an appendicitis operation, should be diagnosed except under the only true-color-value light.

Petroleum oil is the basis of the greatest corporation in the world, and the principal factor in judging of its quality is its color, and the white Moore light is now being adopted after the most severe tests as the standard for the evaluation of oils.

Bank note companies and other lithographers and color printers are delighted

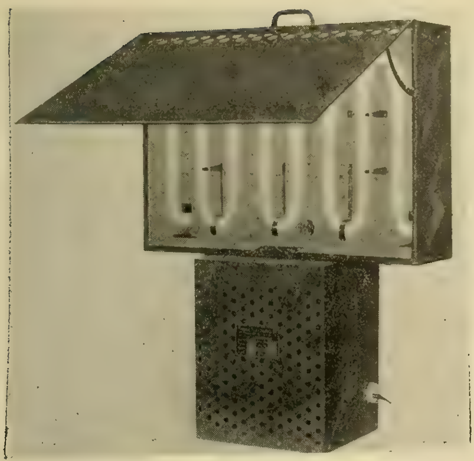


FIG. 3.—MOORE LIGHT WINDOW.

to know that rush orders cannot now be delayed by the fall of night.

An almost unlimited number of different gases can be used if desired by the Moore system, but commercial considerations point to two most prominently: First, CO_2 for its color qualities, and, second, nitrogen for its high efficiency.

As might be supposed from a knowledge of its spectrum, CO_2 has high actinic value, and is, therefore, very suitable for photographic work. Comparative tests in this respect were made between two similar Moore light tubes, except that the gaseous conductor of the one was CO_2 and the other nitrogen. The results showed that for the same intensity of light per foot, photometrically measured and the same length of exposure, the photographic plate or paper was affected about doubly as much by the white CO_2 light as by the yellow nitrogen light. But since twice as many watts are required to produce a given intensity per foot on white CO_2 light as the yellow nitrogen light, it was found that for the same total wattage per tube, the same actinic value resulted. However, it is preferable to use the CO_2 light, especially for portrait photography, because it has the great additional advantage of perfect color values.

Moore light vacuum tubes 1¾ in. diameter, whether white or yellow, consist at present of four standard types: A, loops; B, hairpins; C, straight runs, and, D, units.

The loops, hairpins and straight runs are made in lengths of 60 and 114 ft., and vary in total watts consumed from 1600 to 3200, and in hefners per foot of tubing from 9 to 18.

A long tube has both of its terminals, which contain the electrodes, confined in a single terminal box. The same is true of the hairpin tubes, except that each half of the tube's length is parallel to the other half and at a distance of 6 in. from it.

In the case of the straight run tubes, but one end of the tube enters the terminal box containing the transformer; the other electrode is incased in what is known as the "far" terminal box by a highly insulated wire in an iron conduit immediately over the glass lighting tube. All of the current passing through this wire must also pass through the lighting tube, and therefore it has a value of about one-quarter of an ampere, which in case of discontinuity of the conductor in the conduit is not even sufficient to heat the conduit to a temperature high enough, so that its location can be detected by the hand.

Fig. 1 shows two such tubes on the ceiling of a portion of the New York Post Office. A plan of this entire floor is shown in Fig. 2. From it will be noted that 35-114 ft. tubes placed on the ceiling

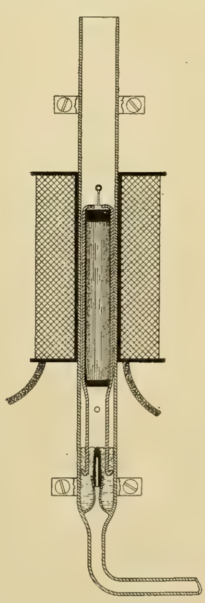


FIG. 4.—STANDARD FEED VALVE OF MOORE SYSTEM.

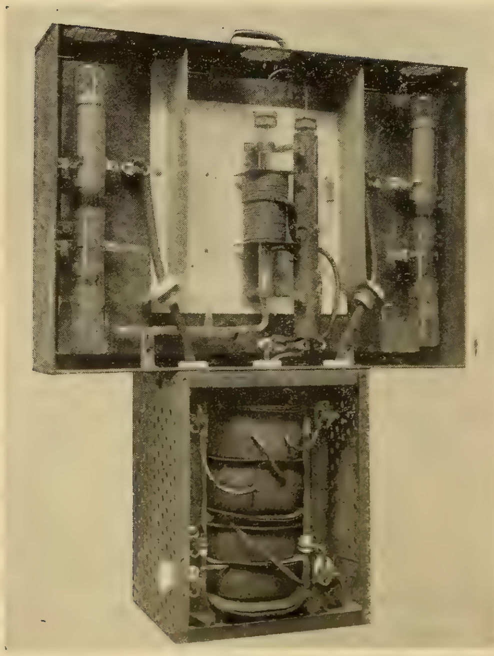


FIG. 5.

are used to uniformly illuminate this area of 40,000 sq. ft. and more efficiently than is possible with any other system of lighting. Tests of the Government authorities indicated 5 lumens per watt in comparison with 3 or 4 lumens per watt generally claimed for tungsten lamps over areas somewhat similar. The color of objects under these yellow Moore tubes is very closely the same as that under the ordinary incandescent or tungsten lamps, and this light is rather flattering to the appearance of the employees rather than otherwise.

These tubes are subjected to the most severe strain possible, since it is necessary that they operate continuously twenty-four hours each and every day, but the life of each tube before it becomes necessary to replenish its simple but automatic gas supplying apparatus approaches 10,000 hours.

Fig. 4 shows a standard feed valve as used in the terminal boxes of the long tube system and as formerly used in the semi-portable Moore light windows as shown in Fig. 3.

Fig. 5 is a rear view of Fig. 3, and shows such a Moore light window tube equipped with feed valve, together with the automatic carbon dioxide generator beside it and the tube electrodes. Beneath the window proper is shown the specially designed leakage transformer of the shell type. These two pieces of apparatus are easily separable and are shipped separately. The feed magnet coil of the "artificial window" is connected in series with the service side of the transformer.

A standard CO_2 (white) Moore light window D-8 requires 1500 watts of 220 volts, 60-cycle current and a standard nitrogen yellow Moore light window—D-7 requires 750 watts of 220 volt, 60 cycle current.

The CO_2 windows are especially adaptable to all uses where colors are of importance. When used in dye houses no special room is now required, due to the addition of the front reflecting cover as shown on the window in Fig. 3. This front cover effectually screens out all deleterious forms of light that may be adjacent; it very greatly intensifies the light on the samples held beneath it to be matched; it perfectly shields the eyes of the observer, which is a very important factor, and it further makes thoroughly practical the use of very low frequency alternating current when necessity requires for color matching purposes.

For example, if a single phase 40-cycle current was used on a long Moore tube that was required to illuminate a large room the image effect of the light due to the low frequency would prove annoying, but when such a low frequency light is confined to the small area directly beneath the front reflector of the white Moore light window the objection is removed and the light becomes eminently satisfactory. Since a large number of the great mills of the textile industry are equipped with only low frequency currents, this fact is becoming of considerable commercial importance. Of course, the transformers for operating these "windows" are made to suit any desired frequency or voltage. When direct current only is available, a small specially designed rotary converter is used for example to transform 220 V. direct current to 156 V. alternating current, which is connected directly to the window transformer designed to suit.

The Moore long tube system, with its various modifications, meets in an almost

ideal manner all the necessary requirements as regards diffusiveness, color, safety, efficiency, etc., for illuminating large areas. Its permanent erection on the premises to be lighted has involved experienced men and specially designed auxiliary apparatus. Both of these factors are steadily becoming greatly simplified, and in like proportion the vast field for the long tube system is broadening.

But great value will always be attached to forms of Moore tubes that can, first, be entirely constructed in the factory, and, second, be shipped by freight or express to all parts of the world instead of the field of operations being confined to small localities where specially instructed installers are now available and the growth of the number of which must necessarily be slow. However, such apparatus until very recently did not exist. Shipable apparatus could not be easily constructed, because the standard feed valve would permit air to leak into the tube should the feed valve be inverted.

Of course, the long tubes thus far described are built *in situ,* and besides this, their great dimensions precluded any possibility of their being portable. Therefore, the first step toward portable apparatus was the construction of a tube, as shown in Fig. 3, which is contained in a sheet metal case above and separable from the transformer of about the same dimensions as an ordinary traveling dress-suit case.

This form of Moore tube equipped at its rear with a standard non-invertible feed valve found a field of considerable usefulness for various forms of color matching, but it had to be "personally conducted" from the factory to its final location to avoid its being inverted and thereby ruined by the small pool of mercury of the feed valve flowing away from its porous plug and the resultant rapid impairment and complete deterioration of the vacuum in the lighting tube so that no light could be obtained when the current was applied.

Lighting a Large Steamship Pier

A Structure Nearly a Third of a Mile Long Successfully Lighted by Flaming Arc Lamps

By F. S. Tuerk.

Steamships, like railroad trains, run on schedules, not maintained as strictly, of course, yet maintained pretty closely as to sailing time at least. If you happen to be at the pier when an ocean greyhound sails you will see plenty of life and action right up to the minute the line is cast off, but at the same time there is no undue haste or confusion. Perhaps this same ship arrived four or five days late, with a full cargo, and only day and night work, with an extra gang of stevedores, made her sailing on time possible. Surely without modern carrying and unloading machinery and good pier illumination this would not be possible.

It has taken steamship companies a long time to see the value of good illumination. Many of them have not seen it yet, in fact; but some have, and within the last few months various illuminants have been tried with varying results, due as much, perhaps, to the architectural designs of the piers as to anything else.

An architect in designing a modern steamship pier keeps three things constantly in mind—convenience in handling the cargo, large storage capacity and low insurance rates. In every modern pier these three principles have been carefully worked out. The question of lighting—that is, artificial lighting—has until recently rarely received serious consideration. After a pier has been finished, or so nearly so that the objectionable features, from a lighting standpoint, cannot

FIG. 1.—FLAMING ARC ILLUMINATION ON FABRE LINE PIER, BROOKLYN, SHOWING EFFECT ON FREIGHT FLOOR LEVEL.

be changed, the question of lighting arises. Then it is up to the illuminating engineer not only to light the pier, but to do it well, for at present the night-gang employed at these piers often exceeds that employed during the day. The very nature of the work and the class of labor employed make good light imperative, and the problem of efficiently lighting these large semi-open interiors is one now receiving serious consideration among illuminating engineers.

Various illuminants have been tried, but the flaming arc lamp, on account of its great brilliancy, penetrating power and economy, seems to be the best. An excellent example of pier illumination is afforded at the new pier of the Fabre Steamship Company, at Thirty-first street and Second avenue, Brooklyn, New York.

This pier is the largest in or about New York, being 1476 ft. long, 150 ft. wide and 35 ft. high. Being only one story in height, it is lighted during the day by means of skylights, and whatever light comes in through the open doors. In fall and winter it becomes necessary to turn on the lamps as early as four o'clock.

The present lighting system, which has been in operation about a month, consists of 24 flaming arc lamps, 22 of which are hung inside the building and the other two outside the building, one at either entrance. The lamps are hung in two parallel rows, there being 11 lamps in each row, hung about 120 ft. apart, the distance between the rows being 50 ft.

Power is taken from a 2200-volt, 3-phase, 60-cycle, alternating current transmission line, which is brought into the building near the front entrance and stepped down to 115 volts by a transformer. From the transformer a primary circuit of copper wire is run the length of the building. The entire lighting system is controlled by five control boxes, so wired that three of them control four lights each, and two of them six lights

each, the lamps being connected two in series. This pier is so long that three vessels can be loaded at once, if necessary, and in that case all of the lamps would have to be burning. This seldom happens, however, a dozen lamps being a fair average load.

One of the obstacles met with in lighting this pier was the elevated platform shown in the photograph. It was thought at first that this platform, which extends the whole length of the pier, and is used for the convenience of passengers, would throw such a heavy shadow as to make the proposed plan of hanging the lamps impractical. It has been found, however, that while this platform is over 8 ft. wide, and but slightly below the level of the lamps, the row of lamps parallel to the platform, but about 50 ft. from it, throw such a penetrating light as to almost entirely overcome all shadows.

As in the case of foundries, machine shops and other large interiors, it is a great advantage to be able to hang the lamps as high as possible on a pier. Take the case of the Fabre line pier; this line operates a line of ships between Naples, Marseilles and New York, and its cargoes are principally olive oil, olives, wines, raisins, nuts and grapes. The last three are extremely bulky, and when unloaded are often piled almost ceiling high. One cargo recently unloaded contained 35,000 kegs of grapes alone, and this was but a part of one cargo being unloaded at that time. Another ship was unloading at the time, and another one was due the next day.

This will give an idea of the necessity of large unobstructed storage capacity and good light. If anything but flaming arcs were used it would not be possible to hang them high enough so that the cargo would not cut off a great deal of the light.

FIG. 2.—SAME PIER, SHOWING EFFECT OF ILLUMINATION ON ELEVATED PLATFORM OR RUNWAY FOR PASSENGERS.

The Illumination of a Large Iron Foundry

By W. A. D. Evans.

The foundry presents several special problems in illuminating engineering, involving both physical conditions and physiological effects. Perhaps the first of these conditions to be considered is the almost entire absence of diffused reflection of any kind. The interior of the building and the materials worked on are of so dark a color and such a nature of surface as to be highly absorptive. As a result of this physical condition a greater total volume of light must be used, and greater care taken to avoid troublesome shadows than in nearly any other case of illumination that is purely utilitarian. The subjective illumination, or surface brightness of molding sand for a given physical intensity in foot-candles, is far less than in most industrial cases. Furthermore, the nature of the work itself necessitates looking into cavities in this dark-colored material, and hence the need for general diffusion, or at least an absence of sharp shadows, is imperative.

On the other hand, the construction of the room, especially in the case of large works, is such that the use of individual or local light-sources is wholly impracticable. The foundry in nearly all cases is a large room without a ceiling; and in the case of heavy work has a traveling crane running the length of the room on tracks placed just below the roof trusses, so that all light-sources must be placed above these traveling cranes.

The problem is still further complicated by the fact that as soon as pouring begins the room becomes filled with smoke

FIG. I.—THE FALK COMPANY'S FOUNDRY, MILWAUKEE, WIS., SHOWING EFFECT OF COOPER HEWITT ILLUMINATION.

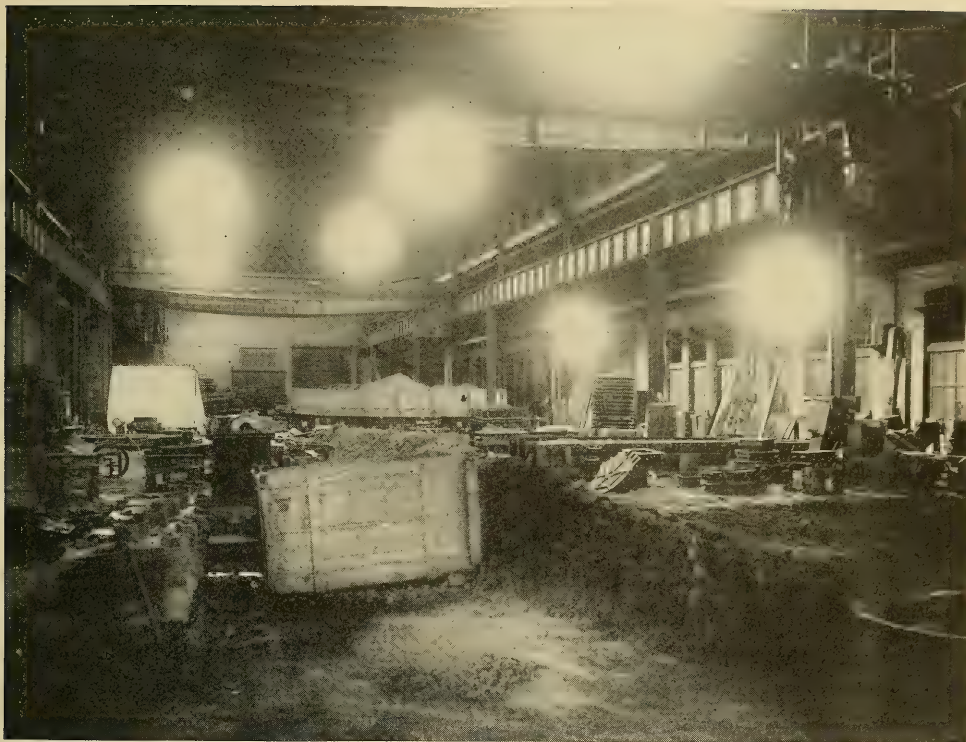


FIG. 2.—ANOTHER VIEW OF THE SAME FOUNDRY TAKEN IN ONE OF THE EXTENSIONS.

and steam, which is powerfully absorptive of light.

The problem, then, is to produce by lamps suspended at a considerable height from the floor a general illumination of sufficient intensity to enable the workmen to see distinctly on a dark-colored and absorptive surface of such a character as to throw many shadows, and even when the air of the room becomes saturated with smoke and steam to be able to see their way about, so that they can safely and quickly handle the ladles of molten metal. This is certainly a list of requirements that would tax the capacity and quality of any system of illumination.

Taking up the conditions in order, the necessity for a high intensity of illumination in order to produce the necessary surface brightness requires the use of high power light units. Physical intensity, which is so generally used as a measure of the illumination required, must be carefully discounted for loss in visual acuity. In this respect, the color of the light used plays an important part. The phenomenon first observed by Purkinje, that visual acuity, or the ability to see clearly at different intensities, depends upon color, finds a practical application. For low intensities the visual acuity is greatest in light of a bluish-green color, that is, a light which contains little or no red rays. The light of the mercury vapor, or Cooper Hewitt lamp, is the only commercial light-source at the present time whose light possesses this peculiar quality. One of the chief advantages of this property of giving a higher degree of visual acuity for a given physical intensity of illumination is in producing a sufficient visual effect in shadows where the intensity is necessarily reduced. The practical result of this is that the cavities and other parts of a mould that are necessarily in shadow can be more clearly distinguished by light of this quality than by the ordinary yellow or orange light of other sources.

This property of the light of the Cooper Hewitt lamp gives a very deceptive ap-

pearance to the illumination produced by it at first sight, the impression being that the room is comparatively dark. As soon as it is put to the actual test, however, by an attempt to distinguish small objects, or details in shadows, there is invariably a feeling of surprise at the remarkable ease and clearness with which the objects are perceived.

The necessity for placing the light units at an unusual height is fully met by the high total output from the Cooper Hewitt lamp, especially the double tube type. Such lamps can be placed on a level with the roof trusses in foundries where traveling cranes are used, and will produce a general illumination of practically absolute uniformity, while the large luminous surface insures an unusual freedom from sharp shadows as well as preventing glare.

The argument has generally been advanced that yellow or orange light is superior in its power to penetrate fog and smoke to the rays of shorter wave lengths —green and blue. Although this has been disputed on purely theoretical grounds, the point may be passed over without academical discussion, and the greenish-blue light of the mercury vapor lamp judged by its practical results. It is found in actual practice that the men can see to pass about among the moulds even in the thickest fog and smoke during pouring with fully as much certainty and convenience as by the yellow or orange light of other sources. Even though the theory be true—though it has not been proven that fog is more absorptive of green and blue light—it is not impossible that this may be offset by the Purkinje effect; that is, the ability of the eye to see in a much lower intensity by light of this color. At any rate, the test of use, which after all is the court of last appeal, has shown that light of this color meets every requirement as to quality for foundry illumination. In more than one case where trial installations have been put in the workmen themselves have declared their willingness to pay for the lamps rather than to have them removed or go back to the previous method of illumination.

The particular foundry in this case is a modern building 220 ft. long, and consists of three contiguous uprights, with lean-tos on each side. The central section is 80 ft. wide, with the bottom of the roof truss 42 ft. from the ground. The traveling crane, running the length of the building, is 25 ft. above the floor. An interior view of this section is shown in Fig. 1. It is lighted with 22 type H H Cooper Hewitt lamps, placed 5½ ft. below the bottom of the roof trusses, and consequently 36½ ft. above the floor. The specific consumption is, therefore, .47 watts per square foot per floor area. The illustration gives a very fair representation of the general effect of the illumination. It will be observed that all details show as clearly as under the best daylight conditions, there being no dense shadows, and the illumination being perfectly uniform.

Fig. 2 is a section which has a 50-ft. span, the bottom of the roof trusses 32 ft. above the floor and the traveling crane 21 ft. Thirteen type H H Cooper Hewitt lamps are used here, but are placed in one end of the room, where the moulding is done. The photograph shows the same characteristics as to absence of shadows, clearness of detail and uniformity of illumination as in Fig. 1.

Railroad Illuminating Engineering

VII.—Paint Shop Illumination

By Harold Kirschberg.

The ability to analyze a problem into its salient features has been very aptly stated to be nine-tenths of an engineer's attributes. If such be the case, a discussion of an engineering problem will more fully serve its purpose if an analysis is presented rather than a solution, and in as much as a new field of endeavor introduces itself by introducing a problem to be solved before the solution is a known

quantity, the scheme of analysis is particularly applicable to the field of illuminating engineering.

An Analysis of the Problem.

The author has from time to time presented in the pages, analyses of the various special and peculiar problems included in the field of "Railroad Illuminating Engineering," and trusts to be able to draw attention to other similar problems of interest as they arise. By reason of the very rapid strides which have been made during the past five years in the manufacture and application of the various luminous sources and methods of lighting now at our command, and the outlook for still more and further development in these directions in the future, it is manifestly not only inadvisable but also almost impossible to furnish solutions to be applied as absolutely standard for any given set of conditions. In addition, when such conditions vary not only among but also in themselves, each problem must be considered on its individual merits and satisfied by suitable variation of previous experience with similar cases.

Among such individualistic problems presented by the requirements of a railroad is the illumination of a paint shop in which car work is done. Any paint shop may present the same conditions of color, surface finish, fineness of work, etc., prevailing in the shop under consideration, but those conditions, not very simple in themselves, combined with further limitations imposed by the enforced comparative location of lighting units and work, allowable space available for lamps and electrical conditions, make the successful meeting of all requirements an achievement which can only result from a careful analysis.

A Special Case.

The shop in question is about 350 ft. long by 72 ft. wide, with four tracks running the entire length of the building. These tracks are usually full of cars upon which both inside and outside painting is to be done, which includes work both on top and under the car body and on the trucks. Between the sides of cars is a space 8 ft. 4 in. wide, usually occupied by scaffolding adjustable on posts about 9 ft. high, with posts about 10 ft. apart. The distance from the sides of the cars on the two outside tracks to the walls is but 4 ft., the height to the highest point of the car above the floor being 15 ft. 6 in. The shop roof construction is of the wooden truss type, filled in with glass, the truss chords being 19 ft. above the floor level. The interior finish is whitewash.

The work done includes painting of the top, sides, ends and bottoms of car bodies, and on the car trucks and all interior painting and staining of cars finished in woods varying in color from golden oak to mahogany. The colors used range in the series of spectrum colors from green to red, and include also gold, black and imitation bronze. Fortunately no matching of colors is done on the car, but the necessity for the clear distinction of color difference is still apparent. Work requiring close application is also included in that accomplished and covers such as striping with gold and black on various background colors, lettering and numbering. Much painting is done under the car on the trucks, where the shadow is very likely to be quite dense. To some extent, white and drab enameling and glass work are also performed while the additions of gloss, varnishing, rubbing, graining, filling cracks in old paint and painting of locomotive tenders increase the complicacy of the problem.

Engineering Difficulties.

It is evident that the shop cannot be considered, from the viewpoint of an illuminating engineer, as an open space. The spaces to be illuminated are those between cars, between cars and the walls and inside of cars, with a distribution which will enable one to work comfortably and in no shadow on any part of any car on any track, an intensity sufficient for fine work, and a color value which will show at least the difference between new and old paint originally of the same color, a difference in shade which disappears very readily with the combination of certain lights and certain colors. As a result of the peculiar form of the exterior spaces to be illuminated, approaching that of a long narrow room, large lighting units are out of the question. The lamp height must also not be less than 16

ft. from the floor in order to allow work to be done on the tops of cars.

For work under the car, unless sufficient light comes from distant lamps at a rather small angle, the use of portable hand lamps seems to be the only method of obtaining the desired result, while the interior work makes the use of portable fixtures and connections therefor an absolute necessity. Under these conditions the only thing to be done is to provide a sufficient number of plug outlets on the scaffold posts with a number of heavy and substantial carrying cords, lamps, fixtures and guards. At best, however, the use of portables is to be strongly condemned, due to the danger to person and property which may result from them in a number of ways, and the very poor manner in which the light is used. Needless to say also is the fact that the life of a lamp in such service is merely that which is obtained before it is broken by mechanical means, which may or may not be before it reaches the conventional 80 per cent. line. Economy of maintenance is, therefore, an indeterminate quantity.

General Conclusions.

Considered in all its features, the problem is one which merits good foresight in the design of a lighting system for successful operation and use. Arc lamps have been tried, with poor results, due primarily to the shadows caused by the scaffolding, on which the boards are usually kept in place, or by parts of the car being painted, or adjacent cars. A light having too strong a directional value would cause too high a regular reflection from the surface of the car and so not enable the workmen to distinguish color. It should, therefore, be well diffused, a result easily obtained by several well-known methods. Lighting units with great light flux would obviously not insure the distribution of light desired, while the use of a great number of small units would involve a prohibitive cost of installation and necessitate changes in the architectural features of the building. Furthermore, any satisfactory layout should be capable of being extended at either end of the building to meet any future additions to the shop.

As an addition to the shop presented in the foregoing paragraph, there is another room, used more or less as an open space, known as a varnish room, and necessitating a much simpler treatment. In it general sign work, furniture finishing and other classes of work are done. The list is fairly complete as follows: Painting in all colors, graining, varnishing, rubbing, polishing, lettering, numbering, enameling, making stencils, general finishing.

It may safely be said that any system which will adequately illuminate the first shop will satisfy the conditions in the second. The question of satisfying the first mentioned shop is however, the one of main interest, and the writer presents it as an exceptional one in the field of illuminating engineering.

Architectural Considerations

By Albert Jackson Marshall.

A few years ago, when the use of artificial light was approached by scientific methods, some of those appreciating the necessity of introducing this more or less new element into the work discovered some "horrible" examples of lighting which they claimed were evidence in themselves of the lack of illuminating engineering knowledge held among those who were responsible for such usage; and the one particular class that these investigators singled out to bear the brunt of their criticisms was the ever criticised, but rarely understood and usually unappreciated, architect. Numerous articles have been written, to say nothing of the almost countless words that have been uttered, condemning the architect for the thousand and one atrocious examples of very poor lighting which these investigators, or their disciples, have unearthed. Rarely has one noticed or heard a word from these persons in appreciation for the many excellent features incorporated in these con-

demned and other (that *may* perhaps have been overlooked) lighting equipments, which omission is probably largely accounted for by the fact that among these critics one rarely finds the ability to appreciate the esthetic and other features therein incorporated.

It is rather an easy matter to constantly so criticise—the criticisms usually being of an incoherent and destructive nature—when such criticisms are not met with arguments from and for the accused. Some of these one-sided critics have really become quite bold in the absence of the defence for the accused. I suppose that the majority of these critics feel that silence on the architect's part privileges them to further and greater condemnation; it apparently gives them renewed courage. But the silence which these critics consider evidence of guilt on the part of the accused is part contempt and part indifference, neither of which is related to fear nor respect. If these criticisms, which usually are of a one-sided nature, continue the critics will find themselves not only forever removed from the possibility of cordial co-operation with the architect, but they will also appear ludicrous, not to say ignorant, to their more broad-minded coworkers who are trying to acquire and disseminate a broad understanding of the art and science of illuminating engineering, and will find themselves isolated with but a well-riddled, misconceived idea for consolation.

Unjust Criticism Injuring the Cause of Illuminating Engineering.

While such I believe will be their natural ending, it should be generally understood that these undesirable critics are materially retarding the cause; that they are making co-operation and general broad understanding of the subject almost impossible. It therefore behooves those who really appreciate the subject of the use of artificial light in all of its broad, wonderful fullness, and who desire to see the art and science respected generally, to either educate or silence these retarders. I think that it might be said without fear of contradiction that it is largely due to these criticisms, which in many instances are wholly unwarranted, coupled with a lack of appreciation for all else save the purely commercial, that the art and science of illuminating engineering is *not* making the headway among architects, decorators, designers, fixture houses and other similar classes that otherwise would be possible; and when all else is said and done, it is these latter mentioned people who really have the say in by far the greatest percentage of cases. It would, therefore, seem desirable to co-operate rather than to assume an air of supreme understanding—to give "the other fellow" credit for knowing *something,* for he may know even more than—well, the critic.

The Advantages of Combining the Physical and Esthetic Phases of Illuminating Engineering

There is no question that the scientific side of illuminating engineering, which has principally to do with the physical and mechanical features, is making headway, and receiving daily greater recognition; but if these phases could be presented (and *appreciated*) in their proper relation to the other features involved, and such presentation could be made by a body of men representing *all* phases of the work, progress would be made with considerably greater rapidity. A body of men banded together for the furtherance of knowledge of the use of artificial light must either number among its active members representatives of all phases of the work; otherwise the scope of their knowledge and its effect upon the public will be limited, and rightly so. While it is true that the purely mechanically inclined engineer has received some recognition, yet if one would take the trouble to follow his work it would be found that his efforts have, for the most part, been confined to problems in keeping with his ideas of the subject, and that even in these more or less utilitarian installations his work could be materially improved by the person whom he is usually inclined to so violently criticise—the architect; for rarely does one find a lighting installation so utilitarian that thought should not be given to the "effect" that could and should be obtained. When this type of engineer attempts to design lighting installations for the better class of buildings his effects leave so much to be desired that his criti-

cisms of the architect's accomplishments appear ludicrous.

The intelligent use of artificial light means more than mere efficiency of illuminants and economy of maintenance, just as clothes mean more than all-wool material properly spun, although this very evident fact seems hard for some persons to comprehend. For want of a better term the intelligent use of artificial light has been called "illuminating engineering." This term would probably do as well as any other if the majority of those using it could and would appreciate the work involved; but when there is an inclination to consider only its mechanical phase, it is little wonder that effects based on such an understanding leave so much to be desired.

Efficiency and Economy Not the Sole End of Illuminating Engineering.

For some who either do not know, or who may have forgotten, I might again state that the *real* value of a lighting system *is judged by the effect that it has on the eye and brain,* from the physiological, esthetic and psychological viewpoints. If efficiency and economy are considered as *the* goals, as is ofttimes the case, instead of as a *means to the end,* then the purely mechanical engineer will find that effects so created have fallen very far short of requirements.

From my experience with architects and kindred interests I know that their knowledge of efficiency and economy in the use of artificial light is not as thorough as would be desirable. *I find, however, that they are willing and desirous of obtaining such knowledge, provided it is presented in the proper manner;* but they are unwilling to accept statements offered by men who show, even before they speak, a total disregard for every principle involved in the use of artificial light, except their pet hobbies—efficiency and economy. I also find that the architect and his associates know *far* more about the refinements of light—the effects that may be and should be obtained—than the so-called illuminating engineer.

If we assume—and I think that such assumption is granted by those who consider the subject of the use of artificial light in all its fullness—that "effects" in lighting are the chief consideration; that the knowledge to such end is already largely possessed by the architect and his associates, which knowledge has been obtained not only through study, *but from practice during the past many decades,* it would appear likely that so-called illuminating engineering is going to be *controlled,* not by the mechanically inclined illuminating engineer, *but by the architect;* and that the engineer must content himself with a subordinate position *unless he appreciates the full scope of the work, and acquires the knowledge now possessed by the architect and his co-workers.* In other words, considering the use of artificial light in all possible classes of installations, I feel that "effects" outweight in importance the purely mechanical side; and it should be remembered that these "effects" are not only *created by the architect and his associates,* but that *he has pretty nearly absolute jurisdiction over their material existence,* so that he is *not only the creator, but the master of the situation as well,* and is daily becoming more in authority.

A Practical Reason For Considering "Effects" in Illumination.

I will cite one (there are others) very conclusive, practical reason why the purely mechanically inclined engineer should acquire a broad knowledge of the work for his own protection. With the introduction of the more or less scientific principles into the use of artificial light central stations showed interest in the subject because they thought they saw through the introduction of such ideas means of retaining dissatisfied customers, and likewise for keeping their competitors out. Some of the ideas advanced by those investigators were incorporated in the handling of lighting installations, with the result that some economics were effected and certain other improvements made, and I think that the consumer has been, to a measure, benefited. While the central stations are planned to have retained their customers, and also to have acquired new ones, yet they are likewise somewhat concerned in the reduction of revenue, and are now

considering ways and means of getting and retaining *satisfied* customers while boosting their income. Are they now going to these purely mechanical engineers for assistance, or will they be more inclined to consider the ideas as advanced by the better balanced designers, who are advocating "effect" in the consumer's premises which will harmonize with their surroundings, requiring, as a rule, a somewhat greater allowance in wattage than when only the physical features are considered?

Those who in laying out lighting equipment make it possible for even the small merchant, whose place of business is so often relegated to the ultra-utilitarian class by the engineer, to have a lighting system which will reflect his own personality and individualism, create a new asset in business, and give the store an advertising value which would be impossible to obtain from a mechanically designed installation. The central stations are beginning to realize that something more than "efficiency" and "economy" should be considered in the design of a lighting system, not only as a protection to themselves, but that the consumer may also secure lighting equipment which will harmonize with the spaces in which it is installed. And when it is realized that the consumer is not only more thoroughly satisfied, but the central stations are also acquiring a greater revenue, it would appear that the mechanically inclined engineer will, of necessity, have to introduce some principles of art into his work if he expects to retain what he has thought to be his stanchest friends—the central stations.

The Consideration of Physical Features Alone Leads to Monotony of Effects.

One of the most characteristic and objectionable features of the mechanically designed lighting installation is the appearance of "sameness." There is nothing which more thoroughly dulls the senses and quenches inspiration than the effect produced by this monotonous sameness in equipment and construction. Nor is there anything more discouraging to those who really see the subject in all of its fullness, and thereby appreciate the necessity of handling it in a broad and intelligent manner. Sameness indicates lack of originality and thought on the part of the person responsible for the installation.

Let me, as a further illustration of this point, take a more or less utilitarian problem, such as a drug store. You may find such store fitted up in a modern manner, the fixtures and equipment costing perhaps thousands of dollars, while the lighting installation, if installed by the purely mechanical engineer, may be about as well suited to the surroundings as an unprotected candle would be on the most exposed part of a lightship. Further up the street the same type of lighting unit may be found in a 10 x 20 delicatessen store. It is reasonable to suppose that these units are not equally well suited to both places. One might go on enumerating a thousand and one examples of such misusage of lighting paraphernalia; but this simple illustration I think makes my point clear. Lighting men should break away from the idea of using the same character of equipment in different installations, irrespective of conditions and environments.

Idealism Is Not Easily Discouraged.

Happily, people who represent things that make life really worth living are not the sort that get discouraged. What do these creators and guardians of the better things in life care for *destructive* criticism, unless it be to urge them to higher levels? Why should they *subordinate* their understandings to the results of a slide rule when their conceptions are from God's greatest gift to man—the brain, through which they are empowered to "see" effects far more clearly defined and more wonderfully beautiful and truly satisfying than it is possible to obtain through any mechanical instrument?

If the physical features of illuminating engineering were set forth in a manner which would show appreciation for the other features involved and show signs of a desire for co-operation—and I would like to add that co-operation is *not 90 per cent. receiving,* but ofttimes means *the giving up of more than one-half*—I think that the art and science of illuminating engineering would receive an impetus which would carry it into fields of work where all would be benefited.

FIG. 1.—COURT THEATER, CASSEL.

The Lighting of Large Halls

By Dr. Robert Grimshaw.

In lighting large halls, such as are used for concerts, banquets, etc., the special conditions demand special consideration. The illumination must be strong enough to be cheerful and inspiring, yet blind no one; and there must not be so much heat generated as to make the guests or others uncomfortable. Not only the tables, stage, etc., but also the ceiling must be well lighted, else the effect will verge on the funeral. It is desirable that the lights develop no combustion gases which would render the air less healthful and also serve to depress those breathing it. The lamps should be noiseless, as sizzling or frying, sputtering or roaring, renders either conversation or public speaking difficult, and detracts from the pleasure of a musical entertainment not only by interfering with the tones themselves but by "putting out" the soloists. The tone of the light must be such as to bring out to advantage the complexions and toilets of the ladies, and enhance the color effects of the general decoration of the hall. Add to this the desirability of having plentiful light, regularly distributed and generated at low cost and with no danger from fire, and the problem seems sufficiently complicated to make the decision one requiring considerable knowledge, experience, judgment and thought.

To comply in every particular with this rather exacting set of requirements, there seems to be available but one source of light—namely, electricity—but this is applied in many and very various manners in the way of both arc and incandescent

FIG. 2.—A WINE RESTAURANT.

FIG. 3.—AUDITORIUM, COURT THEATER, CASSEL.

lamps, differently placed and arranged in private and public buildings.

The table herewith, on the authority of Professor Wedding and taken from the *Elektrotechnische Zeitschrift*, gives data furnished by the Siemens & Halske Company of Berlin, concerning the effects on the air of the rooms of their tantalum lamps in comparison with other sources of illumination, incidentally giving some interesting data concerning the heat and carbonic acid evolved by human beings:

Source.	Evolved hourly. Kilogram-Calories.	CO_2 Liters.
Petroleum	36,400	530
Alcohol incandescent	16,300	2,770
Auer von Welsbach gas	11,000	1,130
Compressed gas	6,480	670
Lucas lamp	7,820	810
Millennium lamp	5,770	595
Carbon filament incandescent	3,990	...
Tantalum	1,340	...
Pure carbon arc	950	27
Flaming carbon arc	200	12
Human beings per head	75	14

As far as the effect of the light on the natural colors is concerned the various kinds of electric light have the advantage over the average gas lights; either the tantalum or the ordinary carbon arc light revealing the most delicate shades in full beauty and correct value.

Without going to great expense it is possible to get by means of electricity the highest degree of illumination; and as far as safety from danger by fire is concerned this source is claimed to be well ahead of all others. There are few instances of modern banquet halls being lighted other than by electricity. In times gone by there were employed great—shall I say candelabra?—as in the foyer of the Court Theater in Cassel, Fig. 1; but in striving not to detract attention from the beauty of the ceiling, and also not to limit the view from the galleries downwards, these ceiling fixtures were gradually diminished in size and conspicuousness. Nowadays special favor is shown towards fixtures with incandescent lamps in one or more wreaths on the ceiling, as in Fig. 2, which shows the dining-room of a wine restaurant. Very often there are recessed in the ceiling immense crystal basins, or pendants,

FIG. 4.—CONCERT HALL AT BAD NEUENAHR.

FIG. 5.—IMPERIAL PALACE, STRASSBURG.

in which the lamps are contained, as in the auditorium of the Cassel Theater above mentioned, Fig. 3, and in the concert hall at Bad Neuenahr, Fig. 4; or tubular lamps are hidden in the cornice, diffuse a soft mild light on the ceiling and in the hall. It is often, however, desirable to add a few lateral wall branches in order to impart to the hall a cheerful, pleasant appearance, as in the foyer of the Cassel Theater, Fig. 1, and the Imperial Palace in Strassburg, Fig. 5.

Lighting by means of incandescent lamps requires, by reason of the great number of lamps necessary and the high price of artistic fixtures, somewhat higher outlay than for arc lamps. Further, the changing of numerous incandescent bulbs where ladders are requisite is troublesome, and it is, therefore, recommended to arrange heavy overhead fixtures so that they can be raised and lowered as a body, which calls for building in special hoisting appliances. Arc lamps have the further great advantage, that they are more economical of current than the incandescent types. The cost of current for flaming arc lamps is only about one-fifth that of the best metal filament bulbs, the consumption per specific effect with arc lamps being about 0.2, with metal filament incandescent lamps from 1.2 to 1.5 watts per hemispherical Hefner candle. In Germany the average cost of carbons and attention, including the Government tax, which need not trouble Americans, for flaming arc lamps are about 0.1 to 0.2 pfennigs, or, say, 0.02 to 0.048 United

States cents per 100 Hefner candles per hour burned; whereas, for replacing metal filament incandescent bulbs (" pears," the Germans call them) it is much higher.

These considerations often influence the architect or the owner to light the halls with arc lamps.

As a rule, these (the lamps, not the owners) are hung in the hall itself, and the newer lamps are of the half inclosed pure carbon type (" Bivolta ") type, with carbons above or beside one another. In especially well-ventilated halls such as are built nowadays, with technically perfect ventilating appliances like the famous Mozart Hall in the New Theater, Berlin, Fig. 6, or in ballrooms and dancing halls of summer restaurants, arc lamps of the " effective " type may be used directly in the hall.

Under all circumstances the use of the flaming arc lamps is to be recommended where the hall has top lights or a glass roof.

The flaming arc lamp is then hung from the glass roof exactly as in show window lighting. In both instances it is possible to choose the same type of lamp, one with no casing, but only a small bell of clear glass, Fig. 7. To facilitate attention, either the lamp should be arranged so as to be capable of being drawn to one side for attention or the caretaker should have a small carriage running on a track in the iron frame of the glass roof, and by which he can get at the lamps. As a rule, the real top light consists of ground glass, the glass ceiling of the hall being of either clear or colored ribbed glass. In music halls it should be the lower surface of the glass which is ribbed to improve the acoustics.

Many architects avoid having windows in halls, their object being to keep out the street noises. In some cases, however, where there are windows these are filled with decorative glass, and it is desirable to take advantage of this at night; then such windows should have outside of them either flaming arc lights with oblique total

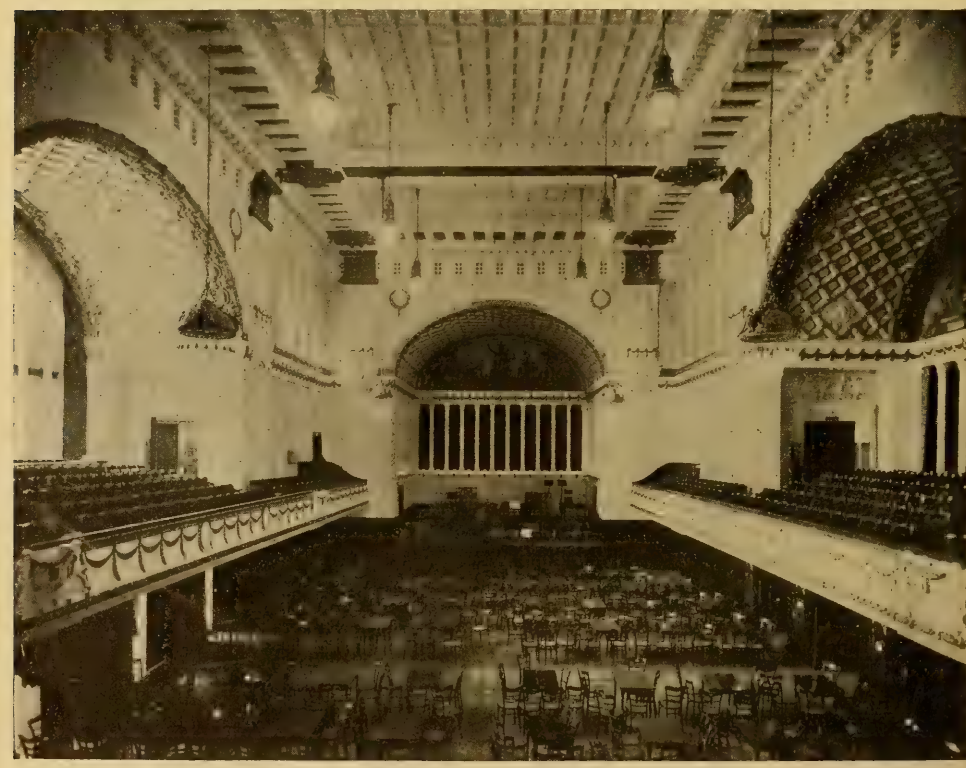


FIG. 6.—MOZART HALL, NEW THEATER, BERLIN.

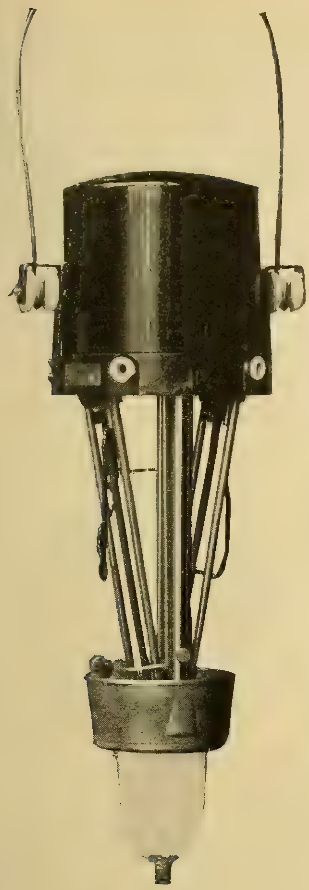


FIG. 7.

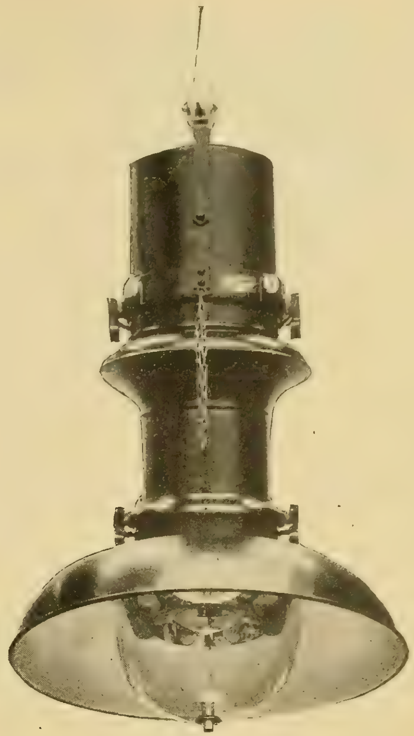


FIG. 8.

reflectors, say, of the Hrabowski type, Fig. 8, or searchlights from an opposite wing of the same building, as is done in the Imperial Palace in Strassburg.

Exactly this last example shows clearly that electric lighting by means of powerful sources is inferior to none in the ability to producing tasteful and magnificent effects in immense buildings.

Fixtures and Accessories

Illuminating Glassware:

Its Relation to Lighting Fixtures

By E. Leavenworth Elliott.

Chapter IV.

There is nothing so difficult to represent by any commercial process of illustration as glassware. This is due to the fact that glass is transparent or translucent, and except where the translucency is sufficiently dense both surfaces of the glass are seen, that is, they are seen by both transmitted and reflected light. It is practically impossible, therefore, to represent a transparent substance by reflection only, that is, with a picture upon an opaque surface. Furthermore, illuminating glassware has two entirely different aspects according as it is seen by daylight or when lighted by the source which it is intended to cover. In all cases of illuminating glassware having a surface decoration it is sold on its daylight appearance. With one recent exception we do not recall a single instance where the manufacturer has attempted to show the appearance of his ware when lighted up for use. We have to content ourselves this time with the daylight appearance of glass as depicted by the camera and the photo-engraved plate. Plain opalescent or frosted glass must depend for decorative effect upon form. This is the cheapest grade and is produced by blowing the glass into iron molds. This process inevitably gives a certain stiffness and mechanical appearance which cannot be wholly obliterated by any selection of curves or angles in the design. The repetition of exactly identical lines and shapes is incompatible with the highest artistic feeling. The cement block made with a face exactly reproduced from a block of rough dressed stone does not offend the eye in itself, but let the entire façade of a building be constructed of these identical blocks, and their mechanical origin is at once apparent. This same feeling is produced by the repeated use of globes or shades that are mechanical duplicates. Mechanical skill and ingenuity in manufacture enormously cheapens products, but this cheapening is always at the expense of art. We must not, therefore, ask too much of the mechanically blown glassware which we can purchase at such remarkably small sums at the present time. It would be an endless task to show all the variations in shape which are given to

FIG. 1.

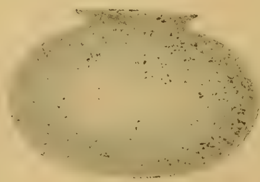


FIG. 2.

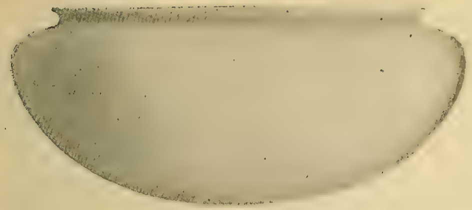


FIG. 3.

FIG. 5.

plain globes. The sphere or ball is a form that exists forever. Artistically speaking it may be considered neutral, since the contour is a circle which has a form of curve that the eye instantly resolves and which, therefore, produces no esthetic feeling any more than does a straight line. For artistic effect, therefore, the contour or profile must be made up of more complicated mathematical curves, such as the ellipse and parrabalum. There is little doubt that the profile should be a composition of mathematical curves rather than curves taken at random.

Figure 1 shows the circular profile, which makes absolutely no impression upon the feelings.

Figure 2 shows an elliptical profile, which holds the eye to some extent and leaves an after-image in the memory.

Figure 3 is a profile still more complicated and consequently holds the attention still further.

These three shapes will illustrate our point sufficiently. The popularity of the so-called "mission" furniture has given rise to the construction of lighting fixtures from square tubing and angular stampings to correspond and this in turn has been followed by lighting glassware having angles and straight lines in profile. (See Figs. 4 and 4a.)

The American is particularly prone to overwork any idea that pleases him. The original mission furniture was as devoid of art as it could possibly be made, being constructed in the simplest manner of squared timber and plain boards. Had the Spanish missionaries been obliged to construct chandeliers for their buildings they most certainly would not have taken the trouble to make their round tubing square. In fact it is difficult to imagine their using tubing at all when wood would have answered every purpose, and had they set about making a shade for their lamps they would likewise have made it in the simplest form possible with the materials at their command. Panes of glass are set in a metal frame might conceivably have resulted from their efforts, or sheets of iron bent into cylindrical or conical form. The square metal tube, which is far more difficult to draw than a round tube, and the square glass shade, which is also more difficult to make than a curved form, follow the letter rather than spirit of mission furniture, the one compelling motive of which is simplicity. The plain pyramid or box of blown glass is not a thing of beauty. The best that can be made of it is to stain the corners or angles in such a manner as to simulate a small lantern with glass panes. Most of the variations on these themes which pass for mission have no inherent beauty and exist by reason of the American's predilection for fads.

Figure 5 is a typical pressed shade with imitation cut design; leave the bottom in this and it will answer even better for a berry bowl than for a lamp shade. In fact a tableware manufacturer made the

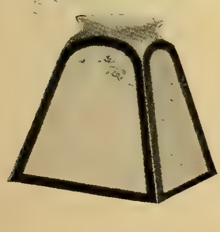


FIG. 4.

FIG. 4A.

FIG. 6.

FIG. 7.

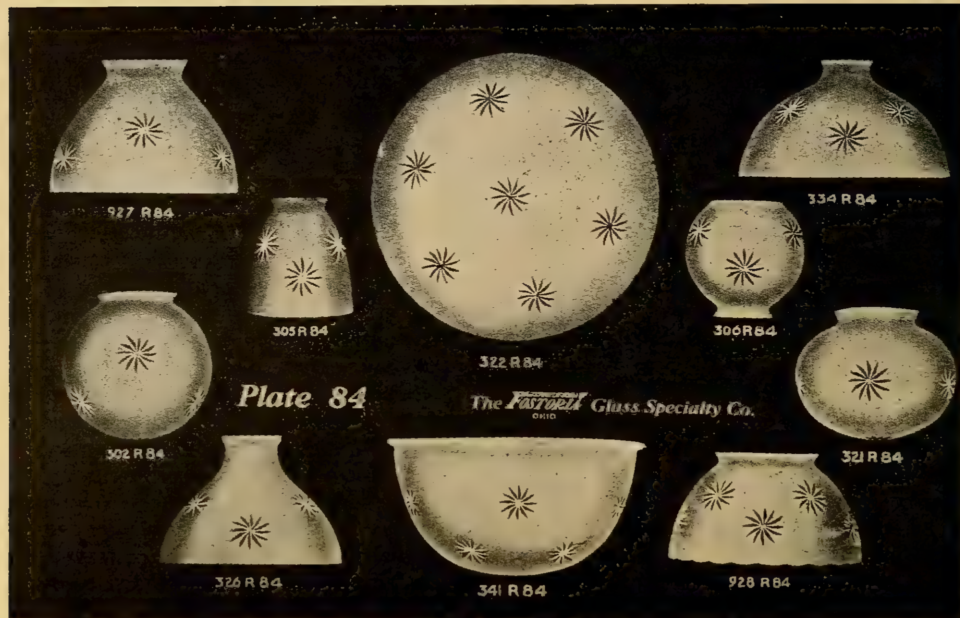


FIG. 8.

same mold answer for both, simply varying one of the parts so as to leave the bottom in when it would be sold as tableware. Nothing more need be said as to their artistic merits as lighting glassware. Fortunately, their popularity is waning, although they are still shown in the catalogs of all the leading manufacturers.

Figure 6 is a common form of prismatic globe, the prisms having no optical purpose but simply a herring-bone decoration of the glass. It probably absorbs one-third of all the light that strikes it and is hopelessly plebeian from the decorative standpoint.

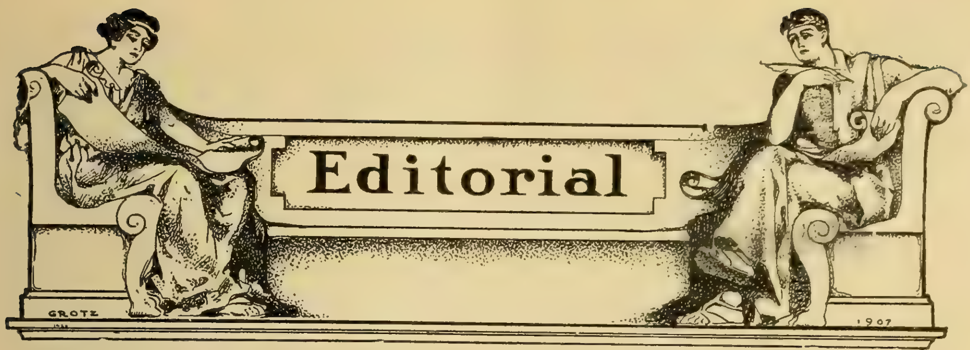
Figure 7 illustrates a globe of alba glass which is peculiarly well suited to this method of treatment. The design shown is of a conventional treatment of the classic order. The effect both by daylight and artificial light is that of carved alabaster. Now that this glass is being produced on a commercial scale it is to be hoped that the designs will be worked out to take advantage of its peculiar inherent beauty.

Figure 8 shows a number of forms exhibiting a permissible use of cutting as decoration, the cutting showing the clear glass against a background of etched or frosted surface. Etching is of two general kinds, deep etching which gives a rougher and more obscure surface, and light etching which gives the so-called "satin" finish. The combination of these two effects with clear glass affords an opportunity for producing an endless variety of designs. By this means any given shape of globe can be given a treatment embodying the motives of any particular period or school of decorative art.

Figures 9 and 10 show how this improvement carried out on a simple electric globe, the decorations running from classical to art nouveau.

FIG. 9.

FIG. 10.



The Government and the So-called "Electric Trust"

Is the Incandescent Lamp Combination a Good or Bad Trust?

Even that most spectacular of trust busters, Theodore Roosevelt, admitted that such a thing as a good trust was possible. The problem of distinguishing the good from the bad is undoubtedly the most difficult judicial proceeding that has ever confronted the American public. The populace has been, since the beginning of civilization, always an extremist. The old Scriptural injunction to "avoid the appearance of evil" is a piece of uncommonly shrewd wisdom. Given one combination or trust which abuses its privileges, and forthwith the populace is ready to lynch everything that has a semblance of the appearance of a "trust." The Communists of the French Revolution put this natural tendency into action when they murdered every aristocrat they could lay hands on, regardless of his private character or public actions. There is a very large element of Communists in our midst at the present time, who, in their self-righteous zeal to exterminate the evil trusts, of which there are unquestionably plenty of examples, would guillotine every corporation or association of commercial interests which can be classed under the odious term "trust," regardless of the actual principles upon which they conduct business and the results which they secure.

It is an open secret—so open at least that all dealers and most large users of incandescent electric lamps are fully apprised of it—that a combination among the manufacturers of these lamps has been in existence for several years, and that this combination controls practically the entire output of the country, and, as a natural result, fixes the prices at which they are sold, both wholesale and retail.

But let us for a moment suppress our wrath at the suggestion of such a combination and look at the results as affecting the "ultimate consumer." In all popular considerations of such topics the dealer is left entirely in the cold.

Prices Not Raised.

The most serious charge usually brought against a trust is that of arbitrarily raising prices and placing them upon a purely artificial basis. This has not been the case with the lamp trust. (We use the word "trust" simply for convenience and the sake of the argument.) The price of carbon filament lamps, which was the only kind manufactured when the combination took place, is no higher to-day than before the so-called "trust" began, although within this time prices of almost every commodity, including labor, has increased to such a degree as to raise a general outcry against high prices. So far as the regulation of prices was achieved by the combination of manufacturers the effect was to bring them all to the level of those charged for first-class lamps at the time of the combination. Even this statement must be modified to allow for a

differential in price of two cents a lamp, which was allowed in favor of those produced in the smaller factories with less adequate facilities for turning out a uniform and high-grade product, and having less prestige in the market.

Competition in Quality Rather Than Price.

What was the result of this fixing of the price at the regular market rate of first-class product at that time? The answer is very simple. Being unable to use a cut in price as a selling argument, all the smaller and less known manufacturers were obliged to sell their product on the basis of merit. Hence, instead of a constant study to cheapen the cost of manufacture, which inevitably means degrading the quality, there was at once instituted a vigorous effort to improve quality. This could have but one effect; within a very short space of time there was practical uniformity in the quality of all the incandescent lamps made in the United States, and this quality was the highest known in the world.

The elimination of price cutting on the part of manufacturers affected but very few consumers. It was the smaller dealer, generally speaking, that benefited from this practice. The temptation to follow Omar Khayaam's advice, "Take the cash and let the credit go," is well-nigh irresistible to the dealer who has no large amount of capital represented in reputation, and who is not keeping one eye on the future in his business policy. Because he has the shrewdness and luck to buy an article cheaply, without too careful an investigation of its quality, is it any reason why he should sell it to an unsuspecting public at a lower price than his neighbor? The small consumer, such as the ordinary householder, was not at all affected by the standardization of prices. He secured his lamps either through lighting companies, which included their cost in the bills for current, or purchased them at the retail price of first-class lamps, whatever price his dealer may have paid.

Comparison of American and European Conditions.

Another interesting study of the results of the combination is a comparison of conditions here and in Europe, particularly England, where at least until recently, competition went on absolutely unhampered. There was the usual struggle to undersell, with the inevitable result of a lowering of quality. Furthermore, such unrestricted competition is directly opposed to standardization and uniformity of product. The American purchaser receives exactly the same kind of lamp wherever he purchases. He can get them from any source and there will be exact similarity in appearance as well as in quality. This condition did not hold in this country previous to the combination, nor does it hold in Europe to-day. Probably no one thing has more retarded the development of electric lighting in England than the chaotic condition existing in the lamp industry. There are no standards of either size, appearance, rating or quality. "You pays your money and you takes your choice," and a mighty poor choice it is apt to be.

America is by all accounts the best lighted country, all things considered, in the world. There may be a few street lighting installations abroad that can outdazzle us, but in the general use of light in the home, the factory, the store and the office, we have them all beaten. If light is a good thing—and who will deny it?—then those who have not only made it possible, but in a measure thrust it upon us, cannot be hopelessly bad.

Development of New Lamps.

Since the combination went into effect in this country, new forms of incandescent electric lamps have been developed which are revolutionizing the electric lighting industry. These lamps give two to three times as much light for the amount of electric current as the older carbon lamp, which dominated electric lighting for a quarter of a century and is still sold at the rate of a hundred million a year or thereabouts. The principle of these new lamps was first brought to a practical consummation in Germany and was immediately taken up by the American manufacturers. Lamps were put upon the market at the very earliest date at which manufacturing facilities and processes were justified; and while the initial prices were necessarily high, owing to the comparatively small

number manufactured and the large amount of experimental work required in perfecting the lamp, they were such as to show a very comfortable economy to the user when the cost of current was considered. The prices have been reduced from time to time since and the quality of the product very much improved, and still further improvements are announced to be put into commercial use in the immediate future.

In order to perfect these new lamps, as well as to keep the quality of the older type at the highest possible pitch, the combination conceived the scheme of establishing an engineering and experimental department which, owing to their large resources, was equipped and manned with the best facilities and talent that money could procure; and nearly half a million dollars annually is expended in this work. It is a common experience in manufacturing that improved processes which increase the quality decrease manufacturing cost at the same time. This has been true in the case of the new high efficiency lamps, and the public have reaped the benefits in the frequent reductions in selling price. The carbon filament lamp had been brought practically to the limit of perfection, as events have proved, when the combination took hold, and consequently there has been no opportunity, especially in view of the constantly increasing price of labor and material, to make such reductions in cost, and the public have benefited only to the extent of receiving uniformly the best possible quality.

Scientific Research.

A word more concerning the experimental and research work will be of interest as exemplifying an entirely new phase of modern industry. While of course much attention has been given to perfecting methods of manufacturing, the more theoretical and highly scientific aspects of the problem have by no means been omitted. Some two years ago a research laboratory, which contains some of the best known scientists in the country, the Government itself having been drawn upon for talent, was instituted to deal with the purely theoretical elements of the problem, even to a study of the physiological and psychological effects of light. It is doubtful if there is an educational institution in the land that has the means of prosecuting scientific research in these directions to the extent of this laboratory, which exists solely as an adjunct to the so-called "lamp trust." The heads of the engineering department are constantly on the alert to pick up promising graduates of the technical schools and annually put a considerable number into service, where those who show adequate talent and preparation are retained permanently, with every opportunity to promote their own positions in the industry.

Now, these are the facts as to results. It seems to all come down to this time-worn question of ethics: Does the end justify the means? Perhaps the only basis upon which this question can be decided, after all, is by an unprejudiced and careful comparison of the two. There are doubtless some means that are too iniquitous in their nature to satisfy the conscience, no matter how beneficent the end accomplished. On the other hand, there are unquestionably many actions which would be contrary to good ethics under certain conditions and entirely in harmony with them under others. Among the questions which may come up in this discussion it is very pertinent to inquire who has been injured by the conditions that have developed? Who would be better off today than they are now if this combination had not taken place? In the face of positive proof of actual benefits it will require much stronger evidence in rebuttal to give a decision for the prosecution than the mere "giving a dog a bad name." There are always two sides to a story, even though that story concern an American trust of the most suspicious character, and it is the part of common justice to "hear the other side" before rendering a decision.

The Rate Problem

Mr. Doherty's paper on rates, presented at the National Commercial Gas Association convention, has again called attention to this important commercial problem. The rate question in the lighting industry seems to be as perennial as

the tariff in politics, and it is a safe prophecy to quote the late President Cleveland's statement that "it will never be finally settled until it is settled right."

The rate problem divides itself into two distinct factors, viz.: The working out of a rate that is equitable to all parties, and the acceptance of such a rate by the public. The latter factor is no less important than the former. Business is being more and more reduced to a science, and the problem of analyzing the cost of producing and distributing illuminants, and of dividing this cost in such a manner that all users, great and small, will pay their just proportion of both cost and profit, would seem to offer no insurmountable difficulties.

But assuming that such a rate has been worked out, how shall the public be persuaded to accept it? This is a problem that requires more than scientific methods applied to commercial transactions. The day when any rate the company chooses can be arbitrarily forced upon the public has passed. Any attempt at the present time to force a rate upon consumers which they did not understand, even though it might be based upon thoroughly sound and ethical business principles, would be more than likely to result in such a degree of distrust and criticism as would end in oppressive and unjust legal regulation. As Mr. Doherty shows in his paper, the question as to what is the proper method of charging has by no means been answered at the present time, and there is still need of a large amount of conscientious and painstaking study of the subject before the question can be definitely settled.

Importance of Educating the Public.

While this work is going on the equally important task of educating the public should be prosecuted. The first efforts in such a course must be directed toward establishing public confidence in the good intentions of the lighting companies. The idea that a public service corporation is by its very nature an unholy monopoly—a Nazareth from which no good can come—is all too prevalent, but the opinion will prevail just so long as the public are ignorant of what is involved in the complicated business of making and distributing illuminants.

If there is anything more than another that lighting companies need, it is publicity of the right kind. They have been getting publicity enough in all conscience, but it has not conduced either to the peace of mind of the managers of the corporations nor to a fair and equitable adjustment of their relations to the public. There is a deep-seated sense of fairness in the vast majority of the people. Differences of opinion arise because of the unavoidable differences in viewpoint. No one expects a public service corporation to do business without profit, nor does the individual user of illuminants any more expect to get his own at the expense of other patrons than he does to pay for the illuminant used by others. The only problem is how to show him that the methods of making the charge are just and fair.

The first effort in this direction should be the adoption of the "public-be-pleased" policy. This peculiarly happy expression, coined by Mr. McAdoo in his speech at the opening of the Hudson Tubes connecting Manhattan Island with New Jersey, has already become classic in this city, and if followed up will eventually offset the evil effects of the "public-be-damned" policy, which, unfortunately, expressed only too forcefully the attitude of public service corporations toward their patrons a quarter of a century or more ago. When the electric lighting company in Boston, a year and a half ago, advertised that it had secured a corps of illuminating engineers, whose services were at the free disposal of its patrons for the purpose of enabling them to obtain better results in lighting and to effect economies in their bills, it seemed at first like a preposterous statement, and that it must have some ulterior selfish motive back of it. Investigation, however, proved that the offer was genuine, and gradually the public became convinced that the company actually wished to give its patrons the best service possible in the present state of the art, and that the reason for the inauguration of this policy, as plainly stated in their advertisements, was sound business logic, namely, that the better satisfied their present customers be-

came with the service the greater use they would make of light in general, and the more new customers would be added to their lists.

The Policy of Fair Dealing Always Pays.

This is no new discovery by any manner of means, nor is the "public-be-pleased" policy a mere catch-phrase to attract public attention. It is the only basis upon which a public service corporation can expect to build a permanently and progressively prosperous business. A "public-be-damned" policy may temporarily bring larger returns, but the public will take reprisals, sooner or later, that will more than wipe out the temporary advantage. The lighting company that will introduce the public-be-pleased policy in its general service will not be long in securing that degree of public confidence which alone will prepare the way for the successful introduction of any system of charging which is based upon scientific business principles; and as Mr. Doherty points out, there is not the slightest question that a more equitable method of charging than an ordinary flat rate, which almost universally prevails in the case of gas, and to a modified extent also in the case of electricity at the present time, will very materially aid in extending the use of both of these illuminants.

The Advantages of Efficient Light Production

In every improvement which has resulted in the more efficient production of light, that is, a larger percentage of luminous rays for a given consumption of illuminant, the first tendency is always to utilize the gain wholly in the line of economy in expense. Thus, when the Welsbach gas lamp was first introduced nothing was left undone that tended in the slightest degree toward increasing the efficiency. The long, narrow cylinder was used, since it increased the draft and thereby added slightly to the amount of light produced. The chimneys were made of clear glass, and the lamp was generally fitted with a reflector that would give the greatest amount of illumination over the desired field. Quality of illumination was wholly sacrificed to quantity. The same general tendency has been shown in the introduction of the tungsten, and other new forms of the electric lamp.

The Welsbach gas lamp has been sufficiently long in use, and its vast improvement in efficiency over the flame demonstrated, to have brought about a realization that it is not necessary to wring the last candle-power of light from this source, but that a considerable amount of the light produced can be used up in absorption for the sake of producing a complete diffusion, and artistic and pleasing effects. Suppose that a decorative globe does absorb a half of the light produced; it is still a remarkably cheap source of illumination, especially as compared with the lamps and candles of our ancestors, and we may well afford this small actual loss for the luxury of having a light that is restful to the eyes and an artistic effect that pleases our natural sense of the beautiful.

The tungsten lamp has practically cut the consumption of electricity to a third, and there is no possible excuse, in the great majority of cases, for not taking advantage of this economy to secure a light that is at once more hygienic, and more satisfactory from the artistic standpoint. We could use two-thirds of the light of such a lamp in producing pleasing effects and still have as high an efficiency as with the ugly and uncomfortable bare lamp of the older type.

It is a mistake from every point of view to exploit these improved light-sources merely on the saving in cost of the production of light. Light is cheap at any rate. What we want is better illumination instead of cheaper light. If indirect lighting is pleasing for any particular purpose, then have it, regardless of the trifling difference in its absolute efficiency compared to a purely mechanical direct lighting system. If a tinted or art globe pleases the fancy and does not interfere with the proper visual effects or ocular hygiene, then by all means let us have it, even though it take two or three times the amount of light that would be required with a system in which efficiency alone was considered. Light has become so cheap that every one can have it in plenty, and can use it as a luxury instead of a bare necessity.

Notes and Comments

Illumination as Reflected in the Daily Press

A NEW VERSION OF THE "POT AND KETTLE" FABLE

The nuisance of the automobile headlight is a serious one and ought to be abated. This at least is the general opinion of every one except the automobile owner. In view of this fact, to have the automobile drivers complain of the dazzling headlights of street cars seems like a most ludicrous version of the pot calling the kettle black. Nevertheless, this has actually occurred, according to the Schenectady *Union:*

"The Schenectady Automobile Club is sending out letters asking its members their opinion on a proposed campaign to have legislation passed that will require the Schenectady Railway to provide means of shutting off headlights on the trolley cars on the Albany and Troy roads when approaching automobiles coming from an opposite direction.

"Although such a movement might be to the advantage of autoists, General Manager Peck of the railway to-day told why the proposed movement was impracticable.

"'The company is carrying an average of a million and a half people each year on the Albany division alone,' said Mr. Peck. 'I can't see why the lives of these people as well as those who have occasion to cross the tracks should be endangered to benefit a few autoists.'"

As a way out of the difficulty, which will not only reconcile both conflicting interests and benefit the public into the bargain, it is suggested that the road between the two cities be illuminated for its entire length. We noted in these columns in a previous issue two instances in the West in which country roads were to be electrically lighted. The scheme proposed in this instance is, therefore, neither new nor impossible; in fact, we are undoubtedly in the very first stages of a general extension of public lighting to the main thoroughfares of interurban travel.

Mr. Peck has suggested to the auto club that the Albany and Troy roads be lighted by 32 or 50 c.-p. incandescent lights, attached to every other pole belonging to the trolley company. This would eliminate trouble and danger from both the autoists' and trolley company's point of view.

Mr. Peck has written to Mr. C. W. Stone of the General Electric Company and has received a reply to the effect that W. D. A. Ryan, a lighting expert, is now figuring on the problem of lighting the roads.

It is not thought the expense for this improvement would be very great and the railway is willing to join with the counties in bearing the expense.

FIREMEN ALSO WANT STREET CAR HEADLIGHTS SHUT OFF

The extension of trolley lines for interurban traffic has brought into use a large use of very intense headlights. It is, perhaps, this sort of light on cars which run into the city that is objected to by the fire department of Youngstown, O. The following is from the *Vindicator:*

"Fred Weimer, Councilman of the Fourth Ward, wants the headlights on all street cars turned off when the fire whistle blows.

"Mr. Weimer said that the bright lights on the street cars dazzle the drivers of the fire apparatus and serious accidents have been narrowly averted on this account."

AFRAID PARK LIGHTS WILL KEEP THE TREES AWAKE

One of the speakers at the I. E. S. Convention told how he argued in vain with a customer to put a better light over his desk for the sake of his eyes. Failing in this argument, he advanced the theory that light would prevent the growth of hair, thereby producing baldness, to which argument the customer immediately succumbed and ordered the improved illumination installed. An argument equally novel and ingenious *against* the use of electric lights in parks is put forth in an editorial in the Brooklyn *Standard-Union:*

"It is devoutly hoped that the Park Department consulted some noted arboriculturist before deciding to establish its elaborate system of electric lights for Prospect Park. There is a belief that plants require sleep the same as do members of the animal kingdom, and if this is so the shrubs and trees in the park will have a hard time of it after the lights are turned on this week. The displaced gasoline lamps, feeble and few compared with the electric lights, may not

have served the purposes of the users of the park as satisfactorily as the new system, but if there is anything in the theory that trees need darkness and slumber as well as rain and sunshine they may be expected to show evidences of the strain in a year or two."

A description of the proposed lighting of the park is given in the Brooklyn *Citizen:*

"For the first time in its history, Prospect Park, beginning Tuesday evening, December 20, will have a modern, efficient and artistic system of illumination. Up till now, the illumination of the park at night has been supplied by 150 gasoline lamps, mounted on posts of no particular artistic value.

"Replacing the 150 gasoline lamps, there are 750 ornamental iron posts, surmounted by symmetrical lanterns, in each of which is inclosed an 85-watt tungsten electric incandescent lamp. The design of the posts is the work of the Municipal Art Commission, and is practically the same in appearance as the one used in Central Park, although there are some improvements in the mechanical construction which make it easier and simpler to clean the lanterns and substitute new lamps for old."

LIGHTING FEVER BECOMES EPIDEMIC IN BUFFALO

"'I believe Buffalo's side streets and cross streets downtown ought to be better lighted, something after the fashion of Genesee street, with ornamental poles and clusters of lights,' said Alderman Frank J. Eberle today. 'That would be a good subject for both the Council and the Chamber of Commerce to consider. It would pay the Chamber lots better to help improve the city's lighting than to be everlastingly investigating someone.

"'Minneapolis has wonderfully fine lighting and I have just received a letter from the president of their Publicity Club in which he says that Minneapolis' street lighting is one of the best advertising assets the city has. Visitors all notice it. I know I did.'"

The *Enquirer* has this item:

"The Elk Street Business Men's and Taxpayers' Association met last night, appointed a committee of five to urge the Common Council to adopt a resolution giving the street more light."

LIGHT AS A PREVENTIVE OF CRIME

Philadelphia has for more than two years now been industriously planning and installing modern decorative lighting systems in its business section. This work having been brought to a successful condition, attention is now turned to the neglected matter of dark passages under railways, which have proved dangerous lurking places for thugs and footpads. The *North American* says:

"Mayor Reyburn has reached an agreement with the steam railroads whereby they will provide better lighting for streets which pass under bridges and dark arches.

"The improvements will be carried out along lines suggested by Chief McLaughlin of the Electrical Bureau, and Chief Webster of the Survey Bureau.

"Chief McLaughlin announced yesterday that after several months of negotiations the railroads had not only agreed to install the new lighting fixtures in such archways as those under the Pennsylvania Railroad from Market street to Filbert street but would maintain the lights.

"These and other railroad arches and bridges are also to be lined with an enameled metal of light color, which with the additional lights will turn them into safe thoroughfares, instead of dark hiding places for highwaymen and criminals."

PITTSBURG SUBURB NOW WANTS A WHITE WAY

"The Lawrenceville Board of Trade is so taken with the appearance of Liberty avenue, Pittsburg's new 'White Way,' that it wants a similar street in that section of the city. At the meeting of the Board of Trade held this week a committee was appointed to confer with Mayor William A. Magee about getting some new arc lights for that district."

DECATUR, ILL., TO BE ANOTHER BEST LIGHTED CITY

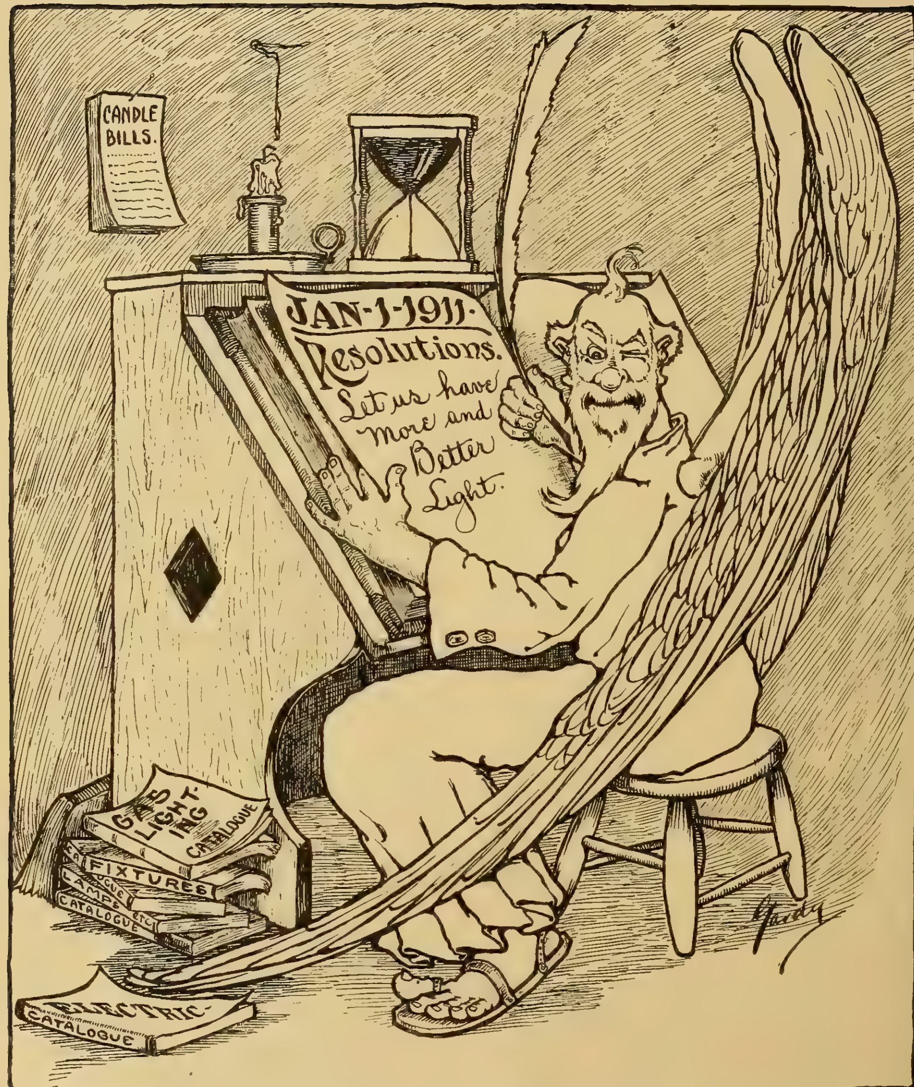
"If plans inaugurated at a meeting of the Retail Merchants' Association last night fructify, the public square of this city will be the best lighted of any business district in the State.

"It is the purpose of the association to place 16 park lamps on the public square, in addition to the 12 2000 power arcs already there."

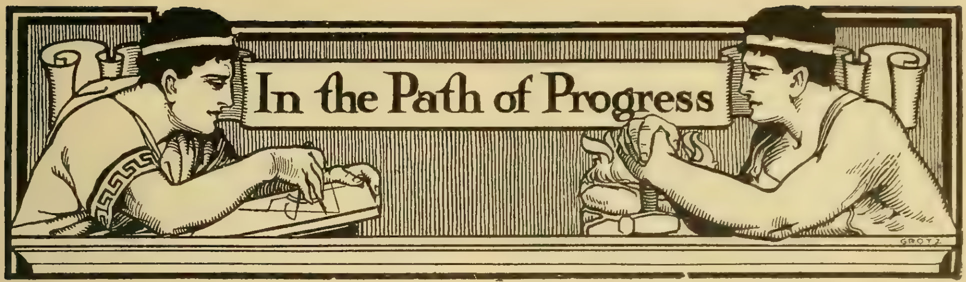
"In a month or so, the 100 block South Water street will be serving up daylight by night. The latest addition planned for the block is another big electric sign that may cost close to $1500, and is to be for the Railway & Light Company. Just what the sign will be is not decided, but several plans are under consideration."

PHILADELPHIA TO HAVE A GAS WHITE WAY

"Gas lighting for a business section of the city is an innovation that is to be tried by the merchants on Market street, between Fifty-first and Fifty-second streets. A permit granted yesterday by the Electrical Bureau provides for the erection of posts on a concrete base, each supporting a light that is much in appearance like the arc light. Thirteen of these lights are to be located within the square designated, and paid for by the merchants."



"HAPPY NEW YEAR"



Another New Reflector Possessing Unique Qualities

Although many new types of reflectors have been put upon the market within the past few years, there seems to be still plenty of room for originality and distinctiveness in the production of this particular adjunct to illumination.

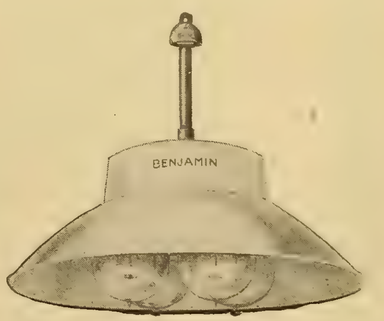
Among the very latest acquisitions in this line is the reflector now offered by H. G. McFaddin & Co., New York, to which they have given the cabalistic name "Mefco." This reflector is of blown glass, the inside being of an unusually pure white opal, and the outside tinted a delicate grass-green. When used with the tungsten lamp this color changes to a pale primrose tint, which is an ideal shade for both its restful effect upon the eyes and in lending a warm, soft tone to surrounding objects. For this reason the reflector is especially suited to home lighting. The design is of the "Sheffield" type, as shown in the illustration. The efficiency of the reflector is unusually high and its distribution curve as nearly ideal as can be obtained from any but purely mirror surfaces. Although a novelty, this reflector possesses a number of properties which are so desirable for a large variety of purposes as to insure for it a large and permanent share of general patronage.

A Tungsten Cluster Fixture for Industrial Lighting

The special object of this new cluster, which is manufactured by the Benjamin Electric Manufacturing Company, Chicago, is for use in large works where high power units are desirable for various reasons, such as the necessity of hanging them high in order to avoid interference with traveling cranes or other obstructions. The general appearance and dimensions of the cluster are shown in the illustration. The fixture has large-base sockets for 250 watt lamps, and is regularly wired in series for 220 volt circuits, but may be supplied in series-multiple for 110 volt circuits. The reflector is of steel, enameled white on both sides.

The distribution from this unit is moderately concentrating, showing a maximum candle-power when equipped with four 250-watt tungsten lamps of 1600 candle-power from 15 to 30° from the vertical; 1200 at 65°, from which angle it rapidly

TYPE OF THE NEW MEFCO REFLECTORS.



THE NEW BENJAMIN INDUSTRIAL TUNGSTEN CLUSTER UNIT.

diminishes to the horizontal. From this it will be seen that it is a full substitute for a carbon arc lamp, and may therefore be used in place of arcs without re-wiring. The lower maintenance charge and greater steadiness will recommend it to such cases. This fact, together with its general good construction and light distribution, should give it a wide range of usefulness in the field for which it has been designed.

"Light Precedes Trade"

In our last issue we commented upon the ingenious enterprise of the Edison Electric Illuminating Company of Brooklyn, in securing the installation of a private decorative street lighting system around a building while yet in the early stages of its construction. The company showed its keen appreciation of the advertising value of this for itself, as well as for the customer, and made use of it in its newspaper advertisements, a copy of which is shown herewith.

A point worth noting in regard to this installation, and the advertising in connection with it, is the mutual benefit received by the three different parties involved, viz., the lighting company, the property owner and the lamp-post manufacturer.

The value of the advertisement to the lighting company is greatly enhanced by its definite "human interest" element; it is not dealing with "glittering generalities," but with a particular installation and a particular citizen, which gives a concrete effectiveness to the argument that is entirely lacking in the general run of advertising talk.

The property owner receives valuable and legitimate publicity, and will necessarily have a very kindly feeling toward the lighting company. The manufacturer of the lamp-posts also receives his share of the credit, and the manufacturers of tungsten lamps as a whole profit by the advertisement. As it transpires that other merchants in the immediate vicinity are following the example set, the city itself will also reap benefit as a final result.

As an all around piece of good publicity, this can certainly be unreservedly commended.

Merchants' Advertising Street Lighting on Bedford Avenue

The attention of all business men is called to the advertising street lighting on the curb of Bedford Avenue from Putnam Avenue to Madison Street.

At this point Mr Hugo Tollner is erecting a fine three-story building, containing ten stores on the ground floor, eight offices on the second, and reception and lodge rooms on the third.

Realizing that light attracts business and that the busiest stores are those best lighted not only within but without, Mr Tollner erected in front of his property six iron lamp posts, each post equipped with five 100-watt Tungsten lamps arranged after the cuts shown herewith.

The posts were made by the J L. Mott Iron Works of 118-120 Fifth Avenue, Manhattan, and those shown indicate but one type of a number of designs at various prices for advertising street lighting. Throughout the West, particularly in Los Angeles, Indianapolis and Dayton, many groups of merchants have combined for the installation of these posts—with the result that material increase in business has been obtained.

The Brooklyn Edison Company, with a view to encouraging this form of merchants' advertising lighting, has adopted a special form of contract through the operation of which the lamps are turned on and off by the Company at stated hours, giving the merchants full benefit of a long evening display The cost for current for this class of service, equipped as these posts are on Bedford Avenue, and turned on and off by the Company's patrolmen, is extremely low.

The Company is prepared to enter into negotiations with individuals or groups of business men with a view to installing these posts throughout the various sections of the City covered by its lines wherever enterprising merchants desire to increase their local trade.

Estimates will be given and details supplied on request to any of our offices.

EDISON ELECTRIC ILLUMINATING CO. OF BROOKLYN

360 Pearl Street

884 Broadway Telephone, Main 4840 (Connecting all Branches) **5114 Fifth Avenue**

A REPRODUCTION OF A HALF-PAGE NEWSPAPER ANNOUNCEMENT APPEARING IN THE BROOKLYN PAPERS.

National X-Ray Reflector Company Enlarges Its Manufacturing Plant

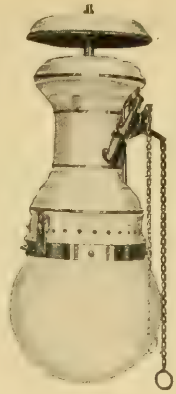
The National X-Ray Reflector Company, of Chicago, which has become known all over the world for its specialty in illuminating engineering, "Indirect Lighting," has been compelled by the greatly enlarged demand for its various illuminating devices to greatly increase its engineering facilities by enlarging their factory quarters at 1119 West Jackson Boulevard. They have also secured the ground floor of the new Brooks Building, corner Jackson Boulevard and Franklin street. This has been finely fitted up for a sales and demonstration room where the "Eye-Comfort" System of Indirect Lighting, as well as their special forms of reflectors, can be adequately shown to those interested.

We tender our congratulations to this company on the excellent progress it has made in the promotion of its particular lines, especially as it was one of the first commercial companies to recognize the value of conscientious illuminating engineering as a basis for the sale of illuminating appliances. Its success is well deserved.

The Welsbach "Intenso" Gas Lamp

Under this trade name the Welsbach Company, Gloucester, N. J., has recently placed upon the market a new multiple burner lamp of the "gas arc" type. The Intenso lamp uses the inverted burner principle and is designed for interior use. The special points aimed at in the design of this lamp are reliability and low cost of maintenance. To this end the Welsbach Company has made a very careful study of the problem from both the practical and scientific viewpoints, with the special aim of eliminating the troubles which lamps of this type have developed.

It is a self-evident proposition that the fewer the parts the fewer the troubles. The Intenso lamp has been reduced to its lowest terms of practical simplicity. It contains a single Bunsen tube, which has the advantage of permitting instant and accurate regulation from the outside without lowering the globe in any case, whatever form of glass may be used and of having a larger gas inlet, which practically removes any difficulties of clogging. The most unique feature is the arrangement of the gauze, which is a necessary precaution against the burner "striking back," in a cartridge form, which can be removed from the outside of the lamp, cleaned and replaced in a few seconds' time. The single Bunsen tube supplying the several mantles affords an automatic adjustment of gas whereby each mantle receives exactly the proportionate amount to maintain it at full incandescence.



THE WELSBACH "INTENSO" LAMP.

It is asserted that the lamp can be maintained at from one-quarter to one-third the expense of the ordinary multiple tube form of gas arc, an assertion which would seem to be borne out by the construction.

The Intenso lamp brings modern gas lighting up to the highest notch of progress.

Over Six Thousand

The National Electric Light Association reports that it is continuing to enjoy the growth which it has experienced so remarkably during the past eighteen months. On December 12 the membership reached the high mark of 6007, inclusive of 904 operating companies and 222 manufacturing concerns. The operating companies and their sections have 4133 employees and members of their staff in Class B membership. The membership in July, 1909, was 3137, and at the meeting of the Executive Committee last January was reported as 4500, so that the net growth during the present year, after dropping 250 individual members for various reasons, is around 1500.

The second annual convention of the managers and department heads of H. M. Byllesby & Co. and affiliated companies will be held at the Congress Hotel, Chicago, January 17-20, inclusive.

Proceedings of Technical Societies

PROCEEDINGS DISCUSSION

The Sixth Annual Convention of the National Commercial Gas Association

This meeting was held in Boston during the week of December 6-13, the annual Gas Show being opened at the same time.

The Association has made steady progress from the start, and particularly rapid strides within the past year. During this time its membership has exactly doubled, and its activities made more effective by the publication of a regular monthly bulletin. The meeting in Boston reflected the vigor shown by the Association during the past year. Not only was the registered attendance large, but those present evinced a keen interest in the sessions.

In spite of the general success of the meeting, however, there were some anomalies which are difficult for the outsider to understand. Illumination is still the big end of the gas business, probably averaging throughout the country 75 per cent. of the total business done in the sale of gas. It would seem logical that the general subject of lighting should occupy a corresponding position of importance in the proceedings of a convention of gas interests. But such was not the case in the present instance. The single paper prepared, which was a most excellent one, was relegated to the rear and run through at the tail end of the last session without time for discussion, like a bill on the last day of Congress.

It is unquestionably good commercialism to cultivate new uses for gas, but it is equally wise to hold to the utmost the one big field which the business already occupies. If the gas interests think they have their present field of lighting safely fenced in against the encroachments of competitors they are hugging a delusion. They have already lost a very considerable amount of territory, which is still held by the gas interests in Europe, a large portion of which might have been held in this country had the gas companies been more alert to the trend of progress in illumination.

The avowed purpose of the Association is to increase the use of gas. To this end the manufacturers of various appliances for using gas are invited to co-operate with the gas manufacturers with a view to mutual advantage. To foster co-operation among all the allied interests, touching the manufacture and use of gas, and to stimulate inventive genius and manufacturing enterprise is a thoroughly laudable purpose and a great work, but it is but half of the commercial problem. It is easy enough to make an article, given the necessary financial resources, but it is commercially worthless until exchanged for the consumer's money. There are two sides to every deal, as well as to the traditional story; there can be no seller without a purchaser.

It is true that purchases may be, and frequently are, made from absolute necessity, and this perhaps has held to an unfortunately large extent in the case of gas; but monopoly alone will never bring out the maximum sale or use of a commodity. In the present state of civilization monopoly invariably fosters resistance. Human nature at the present time resents being driven; and while it will yield to sheer necessity, it will never move one inch farther than absolutely necessary. There are certain commodi-

ties which can unquestionably be more advantageously made and sold through a monopoly than otherwise, and illuminants are among the most obvious cases of such natural monopolies. But a monopoly is by no means an absolute advantage to those possessing it, for the reasons stated; and instead of depending upon physical advantage in the sale of the commodity, it is even more necessary that the good will of the consumers be cultivated than in the case of open competition. Profit always lies in quantity of production, and the difference between what the public *must* use, and what it could be *induced* to use by the right sort of persuasive measures, would easily make the difference between ample profits and an actual loss.

The very first necessity for increasing the use of gas in every case is the overcoming of the natural spirit of resistance to monopoly, and the substitution of a spirit of positive good will on the part of the public. There are just two means of accomplishing this: First, the will on the part of the gas company to give a perfectly fair and liberal treatment to its patrons; and second, the education of the public by every legitimate method of publicity to believe that the gas company is acting in good faith. As Mr. Kelly, speaking at the banquet, so happily put it, "Make your advertising good, and make good your advertising." If we understand by "advertising" all methods of public education, this statement furnishes a complete solution to the whole problem.

No teacher will inspire the confidence which leads to belief who does not teach from a positive conviction of the truth and right of his doctrines. The man who has even a suspicion in his own mind that gas light is a back number, or in any way inferior to other illuminants, will never make any headway, either against competing systems or in the extension of a monopoly. There seems to be to a considerable extent a feeling of timidity, a lack of the agressiveness which comes of conviction, in pushing gas illumination on its own merits. If gas light has lost in prestige it is not through lack of merit, but lack of push on the part of its sponsors.

The arguments against gas have been so long and so often repeated by its opponents, and been left so generally unchallenged by its advocates, that the gas people themselves have come to accept them as facts. It is a case of silence giving consent.

The illumination of the Gas Show, both interior and exterior, was a refutation of any general claims to superiority in quality of illumination made by any other illuminant. Barring the few cases in which gas arcs or inverted burners were commercially exhibited with clear globes, presumably for the purpose of impressing upon visitors the power of the light, the illumination of the hall was distinctly pleasing from every viewpoint. There was brilliancy without the slightest effect of glare, and a color quality that was soft and restful, while the massive and ornate chandeliers supporting the gas arcs showed what could be done with gas illumination on a magnificent scale, if it were worked out with the care and expense that are so frequently lavished upon other systems of lighting. In quality of illumination the hall could not have been better lighted by any commercial illuminant in existence at the present time.

Those who availed themselves of the opportunity of posting themselves in regard to the possibility of modern gas lighting, as set forth in the admirable exhibit of the one of the lamp manufacturers, found that the old handicap of inconvenience in lighting and extinguishing, which has been so hard worked as an argument against gas lighting, has been practically removed by recent developments along this line. Chandeliers were exhibited which were lighted and extinguished by the mere press of a button at any convenient distant point, with quite as much ease as in the case of electric lamps. Of course, this is accomplished by means of electricity, but the source in this case is a single cell of a dry battery enclosed within the fixture itself and which can be easily replaced at a trifling cost as occasion may require, which is not unduly often.

Again, those who have come to believe, either from their own observation or the advice of their architect or fixture dealer, that highly artistic effects cannot be obtained with gas, had only to

examine the fixtures exhibited to be completely disabused of this error. The simple fact is that gas illumination, with the best modern appliances, can hold its own with any commercial illuminant. But too large a portion of the public do not know this, and it is now up to the gas interests to dispel this prevailing ignorance.

The exterior lighting, which consisted of an installation of lamp posts supporting gas arcs placed along the curb in front of the building, was as convincing an example what can be accomplished in public lighting as was the interior illumination in its particular field. In point of decorative effect, brilliancy of illumination, even distribution and pleasing color effect the "gas white way" need admit of no superior; and yet the number of such white ways in actual use could be counted on your thumbs.

Still, evidences are not wanting that the gas interests are waking up to a realization of their opportunities, even though much ground has been irretrievably lost. But the movement so far is only a beginning. If the efforts already made can be continued, and increased in proportion to the opportunities, gas should not only be able to hold its present position but should regain a considerable part of the prestige which it has lost.

The following abstracts from Mr. Macbeth's paper will bear repetition:

"To say that gas companies have not been generally and fully interested in gas lighting is a bold statement which many would feel free to contradict, if same were made by our electric competitors. When we consider, however, that the gas business in this country has been perfected for the last fifty or sixty years, but that it is only within the last three or four years at the outside that the gas companies have been opening showrooms and installing appliances and lamps to show their consumers what may be secured, that burner maintenance, in the large residence field particularly, consists largely of cleaning out or changing clogged open-flame burners, that salesmen familiar with the lighting problem are still more rare, and up to this time have been largely more interested in selling gas by the cubic foot rather than on the broader basis of service, we must agree that there is quite a difference which side of the argument you may take."

"There is also another factor coming in here which is at least worthy of consideration. Frequently, instead of capitalizing our product, we have done our best to depreciate it by telling how cheap it was. American appreciation is largely influenced by capitalization, the dollar is most frequently the hallmark of quality. That gas radiants are ever on the defensive is due to their comparative cheapness, like the boarding house prune, which we have been told is one of our most valuable fruits, but which is kept off the tables of the rich, who suffer physically thereby, solely through its inability to win a classification under the head of a luxury."

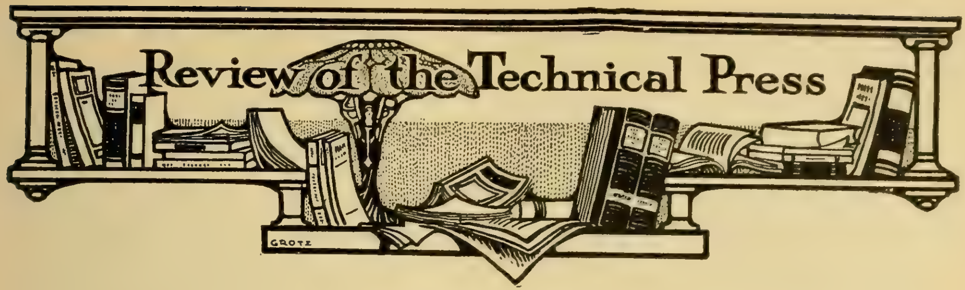
"Many students of this subject have been convinced that the general backwardness of the subject of gas illumination is not so much due to its poor quality, but to its high quality. The comparatively high efficiency from coal pile to effective gas illumination encourages a careless regard for results. If the gas companies believed that their existence depended more largely upon the lighting side of the business, more attention would be paid to this subject and correspondingly better results would be secured."

The Illuminating Engineering Society

The meeting of the New York section was held in the Engineering Societies' Building December 8. Two papers were presented, viz.: "Lighting of the Allegheny County Soldiers' Memorial," by Bassett Jones, Jr., and "Some Notes on the Early History of Standards of Light," by Edward L. Nichols.

Mr. Jones' paper is undoubtedly the most comprehensive treatment of a special lighting installation that has ever been presented to the society. The building offered a number of unique problems and the engineers were practically unrestricted as to cost of either operation or maintenance. Every phase of the problem is thoroughly treated, including the physical, electrical, esthetic and architectural problems. Nearly every modern form of electric lamp is impressed into service. Added to the complete technical data and the discussion of engineering problems, the descriptive matter is of a distinctly literary character, the quality very unusual in scientific papers. It is impossible to give any adequate digest of the paper.

Professor Nichols' paper was a brief review of the history of the attempts to secure a standard light-source, and is valuable as a guide to those who wish to give the subject a more complete study.



American Items

New Publications

THE GAS INDUSTRY, December.

This is the title given to the magazine heretofore published under the name of *Light.* The publication office has been removed from New York to Buffalo, and the general dress of the magazine changed. The new title expresses much more accurately the character of the publication, which from the time Mr. L. S. Bigelow took possession of it, has been devoted to promoting the sale of gas and gas appliances. The text of the magazine is now separated from the advertising section, which is a distinct gain in its make-up. Otherwise the general character of the publication remains the same.

DANGERS OF GASOLINE LIGHTING; *Electrical World,* December 1.

A short article detailing the requirements of an ordinance passed by the city of Colorado Springs covering the installation of gasoline lighting systems.

WELSBACH OSMIUM LAMP PATENTS; *Electrical World,* December 1.

A short article covering the recent granting of four patents to Dr. Carl Auer von Welsbach, covering the manufacture of osmium metallic filament lamps.

COOPER HEWITT LIGHT-TRANSFORMING REFLECTOR; *Electrical World,* December 8.

A short article describing the recent efforts of Dr. Peter Cooper Hewitt to produce a reflector for use in connection with the Cooper Hewitt mercury vapor lamp, having for its object the conversion of violet into red rays.

TANTALUM LAMPS FOR CAR LIGHTING; *Electrical World,* December 8.

A short article describing the experience of the Chicago Railways Company with the use of tantalum lamps for street railway lighting.

GRAPHICAL SOLUTION OF PROBLEMS INVOLVING PLANE SURFACE LIGHT-SOURCES, by Dr. A. S. McAllister; *Electrical World,* December 8.

"A problem in lighting the solution of which has usually involved the use of calculus is that relating to the illumination of the floor and walls of a room by a flat surface source in the ceiling. There is presented a graphical solution of this problem for the case of a flat circular source which possesses the maximum of simplicity."

The author then develops his solution of the problem, which is complete, and at the same time astonishingly simple in comparison with the involved calculations necessary to solve it by pure mathematics. The results are obtained without the use of higher mathematics, and can be used by anyone who will read the article with due care.

ARC LAMP-POSTS OF NEW YORK; *Electrical World,* December 8.

An exhaustive article dealing with the various forms of arc lamp-posts in use in the city of New York, accompanied by numerous illustrations.

VOLTAGE WAVE DISTORTION AND THE LIGHT OF INCANDESCENT LAMPS, by Dr. Clayton H. Sharp; *Electrical World,* December 8.

A letter directed to the editor, relative to Prof. Charles S. Kinsloe's article in

the November 17 issue of the *Electrical World.*

STREET LIGHTING TABLES; *Electrical World,* December 15.

The article contains a series of street lighting schedules for the year 1911.

ILLUMINATING CONTRACTOR'S BUCKET FROM HEAD LAMP ON DERRICK; *Electrical World,* December 15.

A short article describing the method in use by the contractor in completing Evanston Channel of the Chicago Drainage Canal for facilitating the night work. Consists of an electric head lamp which is automatically operated to follow the bucket in its travel from the work in the pit to the spoil pile.

VOLTAGE WAVE DISTORTION AND THE LIFE OF INCANDESCENT LAMPS, by Prof. Charles S. Kinsloe; *Electrical World,* December 15.

A reply to Dr. Sharp's letter in the *Electrical World,* December 8.

NEW LIGHTING ON MICHIGAN BOULEVARD, CHICAGO; *Electrical Review and Western Electrician,* December 3.

An article discussing the new plans for illuminating Michigan Boulevard, Chicago, accompanied by an illustration showing the preliminary model of the new lighting standards for the above mentioned thoroughfare.

TUNGSTEN STREET LIGHTING IN NASHVILLE, TENN., by David H. Tuck; *Electrocraft,* December.

An article describing the new street lighting in Nashville, fully illustrated, and accompanied with wiring diagram.

ILLUMINATION, by J. R. Cravath; *Railway Electrical Engineer,* December.

This issue of the magazine is specially devoted to the subject of lighting and Mr. Cravath contributes the leading article. He treats the subject under the following heads: Measured Efficiency; Lighting Losses; Indirect Lighting; Glare; Remedies for Glare, and The Human Element. The whole subject is treated in a distinctly popular manner, the several technical points under consideration being clearly explained without the use of technical scientific terms. It is an exceptionally good presentation of the subject from this viewpoint.

ELECTRIC LIGHTING OF ROUND HOUSES, by C. R. Gilman; *Railway Electrical Engineer,* December.

The following gives the gist of the argument:

"Since the Mazda tungsten lamp has come into general use, four-light clusters or single lamps are replacing arc lamps, and our experience is in favor of the Mazda cluster. Two or three outlets for attachment cords are now generally placed between each stall. These are indispensable for work inside locomotive tanks and boilers, and in the ash pit under the locomotives. They are a heavy expense to keep in repair, but the light furnished is so much better than the old oil hand torch, that the expense is considered warranted. They also decrease the fire hazard.

"Returning to the general lighting, the conditions as I see them require a mild general illumination, and the portable lamps for special work."

INCANDESCENT ELECTRIC HEADLIGHT LAMP FOR LOCOMOTIVES, by Roscoe Scott; *Railway Electrical Engineer,* December.

Mr. Scott gives a brief résumé of the subject of Headlight Lamps, with a diagram showing the color values of different illuminants and illustrations of tungsten lamps designed specially for the purpose. Mr. Scott's conclusions are as follows:

"The logic of the situation, then, would appear to be this:

"Both kerosene and Mazda incandescent head lamps are less rich than the arcs in the green rays which seem to cause classification signals to be obscured, but a more intense, better focused and steadier light can be obtained from the Mazda than from the oil lamp.

"Whether or not the incandescent lamp, with its simplicity and low maintenance expense, will prove to be the ultimate solution of the much-mooted headlight problem is an open question. Competitive service tests conducted by unbiased authorities will be necessary before any authoritative answer can be given."

ILLUMINOMETER IN RAILWAY PRACTICE, by J. G. Henninger; *Railway Electrical Engineer,* December.

This article is principally devoted to a description of the Sharp-Millar portable

photometer, with notes on its practical use in railway practice.

MODERN LIGHTING, by C. Toone; *Railway Electrical Engineer,* December.

The author states that his article is intended to introduce a few tables and a chart compiled from various sources, including his own tests. He deals with the luminous efficiency of various sources and the intrinsic brilliancies of the same. There is also included a table showing the reflection from different materials commonly used or used on walls and ceilings.

GAS ARC LIGHTING, by L. E. Speer; *Progressive Age,* December 1.

An illustrated article describing some special installations of ornamental gas arc lighting in Chicago.

UNUSUAL INSTALLATIONS OF GAS LIGHTING, by Norman Macbeth; *Progressive Age,* December 15.

An article descriptive of the use of the gas arc lamp, with special reflector for bulletin and sign board illumination; illustrated and accompanied with diagram showing method of making calculations for this form of lighting.

ILLUMINATED SIGNS ON THE BUILDING OF THE GAS & ELECTRIC COMPANY, BALTIMORE, by H. K. Dodson; *Progressive Age,* December 15.

An illustrated article describing electric signs used by the company for advertising its gas business.

OUTDOOR LIGHTING IN ENGLAND, by Norton H. Humphreys; *American Gas Light Journal,* December 5, 12 and 19.

Chapters V, VI and VII, which have been running serially in the past issues of this publication.

THE CHESTER, PA., PEOPLE BELIEVE LIGHTING BEGINS AT HOME, by George W. Thomson; *American Gas Light Journal,* December 5.

Article describing the lighting of the exterior and interior of the offices of the Chester Division of the Philadelphia Suburban Gas & Electric Company.

THE NEW ERA IN ELECTRIC ILLUMINATION, by Rollin W. Hutchinson, Jr.; *Engineering Magazine,* December.

An elaborate illustrated article devoted to metallic filament lamps, containing concise and practical information as to the various characteristics and relative economy in operation of the new systems and equipments.

ILLUMINATION OF A FOUNDRY BUILDING, by Roscoe Scott; *American Industries,* December.

NOTES ON ELECTRIC LIGHTING, by Caryl D. Haskins; *General Electric Review,* December.

Chapter III of this serial.

LIGHTS, INTENSITY, POWER AND VOLUME, by George A. Rogers, Chapter IX; *Optical Journal and Review,* December 1.

This is Chapter IX of the above serial.

LIGHT PERCEPTION AND COLOR PERCEPTION, Chapters I and II, by Dr. F. W. Edridge-Green; *Optical Journal and Review,* December 1 and 15.

INFRA RED ABSORPTION SPECTRA, by Willebald Weniger; *Physical Review,* October.

STUDIES IN LUMINESCENCE—XIV. FURTHER EXPERIMENTS ON FLUORESCENCE ABSORPTION, by Edward L. Nichols and Ernest Merritt; *Physical Review,* November.

This article is fully illustrated and strictly technical.

A NOTEWORTHY INTERRELATION OF ILLUMINATING POWER, DENSITY AND VISCOSITY OF CERTAIN KEROSENE OILS, by G. W. Stewart; *Physical Review,* November.

ORNAMENTAL GAS OUTDOOR LIGHTING PROFITABLE; *Public Service,* December.

WATER STERILIZATION WITH ULTRA-VIOLET RAYS; *Engineering Record,* December 10.

WEST MADISON STREET ILLUMINATION

AND CARNIVALS; *Electric City*, December.

MODERN STORE ILLUMINATION; *The Upholsterer*, December 15.

An illustrated article on some of the lighting effects in the new Gimbel Bros.' New York store.

MODERN HOTEL LIGHTING, by C. T. Soderburg; *Building Management*, December 10.

LIGHTING UP FOR A CONVENTION, by George B. Tripp; *Selling Electricity*, December.

An illustrated article describing the recent illumination for the Republican State Convention at Colorado Springs.

INJURIOUS EFFECTS OF LIGHT ON SOME EYES; *Optical Journal and Review*, December 15.

Editorials

Electrical World:

RAILWAY STATION LIGHTING, December 1.

GLARE IN ILLUMINATION, December 1.

THE LIGHTING OF SCHOOLS, December 1.

GRAPHICAL SOLUTION OF PROBLEMS INVOLVING PLANE SURFACE LIGHT-SOURCES, December 8.

A NOTED INNOVATION IN LIGHTING, December 15.

Electrical Review and Western Electrician:

ORNAMENTAL STREET AND BOULEVARD LIGHTING, December 3.

Electrocraft:

RESIDENCE WIRING, December.

ELECTRIC LIGHTING IN CHINA, December.

THE LIGHTING NUMBER; *Railway Electrical Engineer*, December.

A SUGGESTIVE LIGHTING RATE DECISION; *Engineering Record*, December 3.

WHAT IS DECORATIVE ART; *Upholsterer*, November.

FROM TORCH TO TUNGSTEN; *Electric Journal*, December.

GAS AND TUNGSTEN LIGHTING IN HOMES; *Central Station*, December.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

WIRKUNGEN DER ULTRAVIOLETTEN STRAHLEN, by E. Schreckenburg (*Elek. u. Masch.*, November 27).

An account of some researches on the effect of ultra violet rays. The power of transmitting and absorbing these rays possessed by various solutions is studied, and an account is given of their effect in causing chemical disintegration of various organic liquids, etc.

THE EYE AS AN ELECTRIC ORGAN, by W. M. Thornton (*Phil. Mag.*, October).

ILLUMINATION: ITS DISTRIBUTION AND MEASUREMENT, by A. P. Trotter (*Illum. Eng.*, November).

Mr. Trotter again deals with Errors of Photometry. He gives a summary of the precision attained by various observers with different types of photometers, and also makes some remarks on the avoidance of stray light. The method of "double weighing" in photometry is spoken of with approval as a means of eliminating errors due to this and other causes.

THE NEW BUILDING OF THE INSTITUTION OF ELECTRICAL ENGINEERS (*Elec. Rev.*, November 11; *Electrician*, November 11).

Although strictly dealing with an electrical subject, this article is placed in the present section because its chief interest is the illumination of the lecture theatre and the library, etc. The system adopted in the lecture theatre is unusual. It consists in the use of indirect lighting by a frieze, together with central lighting by mercury vapor quartz tube lamps. In this way glare is avoided, but in some quarters it has been suggested that the effect is apt to be rather "flat."

STAGE LIGHTING (*Elec. Times,* November 3).

This note is mainly interesting because it refers to a somewhat novel method of stage lighting, namely, the use of sources placed right outside the stage in the auditorium, but directed toward it. It is also claimed that the glare from the footlights is reduced to a minimum.

CANVASSING FOR SHOPLIGHTING (*Elec. Times,* October 27).

LAMPS AND LAMPLIGHT: CANDLE POWER VS. ILLUMINATION (*G. W.,* November 19).

GLOBES AND LIGHTING EFFICIENCY (*G. W.,* November 12, 26).

RIVALRY IN STREET LIGHTING (*Electrician,* October 28).

Electric Lighting

ECLAIRAGE PAR INCANDESCENCE, by C. Cheneveau (*Rev. Electrique,* October 30).

A general article summarizing recent work in connection with incandescent electric lamps.

METALLIC FILAMENT LAMPS, by B. Duschnitz (*Elek. Anz.,* September 22).

STREET LIGHTING WITH MODERN ELECTRIC LAMPS, by H. T. Harrison (Paper read at the Inst. of Elec. Eng'rs, London, November 24; *Electrician,* November 25; etc.).

This paper is again of a very general nature. The author, quoting from Mr. Sweet's recent contribution, suggests that a variation in illumination of from 1:4 ought to be the minimum in street lighting, but it is very much exceeded in many of the best London streets. Mr. Harrison also gives data comparing the cost of gas and electric lighting and lays stress on the recent improvement in polar curves of illuminants intended for street illumination by the use of prismatic globes, etc. A feature of the paper and discussion was the insistence of all speakers that better methods of reducing glare were needed.

LA LAMPE EN QUARTZ À VAPEUR DE MERCURE, by M. Leblanc (*Lumiere Electrique,* November 5).

A general description of the new quartz tube mercury vapor lamp; some good illustrations are given showing the method of tilting the tube and starting the lamp, etc.

THE ADVANTAGES OF LOW PRESSURE FOR METALLIC FILAMENT GLOW LAMPS (*Illum. Eng.,* November).

The article briefly summarizes the advantages of using low pressures in the form of improved efficiency and life, reduced tendency to breakage, etc. One interesting system to which reference is made is the method of grouping a considerable number of small glow lamps of low voltage in series-parallel. By this method if one lamp gives way the current can always find its way through the remainder; the only effect is to increase the current taken by each lamp very slightly. Consequently there is practically no change in light if one lamp gives way, and the lighting as a whole does not suffer.

NEUERE BOGENLAMPEN (*Z. f. B.,* October 20, October 30, November 20).

Gas, Oil, Acetylene Lighting, Etc.

RECENT PROGRESS IN GAS LIGHTING, by F. W. Goodenough (Paper read at the opening meeting of the Illuminating Engineering Society, London, November 8, 1910; *G. W.,* November 12; *J. G. L.,* November 15).

The most important item during the past month has been the paper read by Mr. F. W. Goodenough at the opening meeting of the Illuminating Engineering Society (London). Mr. Goodenough

opened his paper by laying stress on the value of the Society as affording an opportunity for gas and electrical engineers and others interested in lighting problems to meet together on a common friendly footing and exchange views. Stress was laid on the great improvements introduced into gas lighting by the invention of the inverted mantle and the development of high pressure lighting. Efficiencies as high as 70 candle power per cubic foot of gas consumed were now attained. Naturally this led to a reference to modern street lighting and a series of photographs were presented showing some of the streets in London newly illuminated by high pressure gas. Mr. Goodenough also described the methods adopted by the Gas, Light and Coke Company, of selecting and testing mantles, and pointed out the inability of the ordinary consumer to attend to his lights properly and keep them in a really perfect condition. For this reason maintenance by the gas company was a great benefit.

In the discussion some novel announcements were made, one of the most striking being that of Mr. C. Carpenter, of the South Metropolitan Gas Company, that his company had been introducing a form of burner with no air regulation. The burner was adjusted once and for all for the standard quality of gas supplied by the company and needed no attention from the consumer. There was also much discussion as to the relative merits of central and side gas lamps in the streets, the general opinion being apparently adverse from centrally suspended lanterns.

Beleuchtung von Bahnhofe durch Hochmasten mit Gasgluhlicht, by G. Himmel (*J. f. G.*, December 3).

The author describes some recent installations of powerful incandescent gas lamps on high masts for lighting railway platforms, etc. He gives detailed analysis of costs. Masts about 7 to 8 meters high and 50 to 60 meters apart are preferred.

Neue Fortschritte der Gasbeleuchtung, by F. Lebeis (*J. f. G.*, November 14).

The author describes several new forms of gas lamps, by the aid of which efficiencies as high as 64 candles per cubic foot are in some cases attained. He is also of opinion that the advantages of the inverted over the upright burner are somewhat exaggerated. One form of improved upright burner mentioned utilizes an insulated tube, the protective covering keeping the temperature up and assisting preheating of the gas.

Gas Intensiv-Beleuchtung durch Pressgas-Pressluft und Niederdrucklampen, by F. Messenger (*J. f. G.*, October 29).

A general article summarizing progress in gas lighting. The author disputes the suggestion that gas will eventually come to be used more and more for heating purposes rather than for lighting.

High Pressure Gas in Birmingham (*G. W.*, October 29).

In Birmingham great results are said to have been secured by using high pressure gas. The pressure in the mains in some districts is said to be as high as 140 inches of water, and the pipes are even tested at a pressure vastly exceeding this.

The Standard Burner Bill (*J. G. L.*, November 22).

The gas industry in Great Britain is still keenly interested in the bill for the adoption of a common standard burner for testing in Great Britain. The bill has just passed its first reading in the House of Commons.

High Pressure Gas in Public Lighting (*J. G. L.*, October 25).

The Antiquated in Gaslighting (*J. G. L.*, November 22).

Illuminated Advertisement Signs and Incandescent Gas Lighting (*J. G. L.*, October 25).

Incandescent Acetylene Burners (*Acetylene*, November).

Contractions used:
Elek. u. Masch. *Elektrotechnik und Maschinenbau.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminating Engineer (London).*
J. G. L. *Journal of Gaslighting.*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The
Illuminating Engineer

Vol. V FEBRUARY, 1911 No. 12

THE GREAT PAINTER

"Light is the first of painters. There is no object so foul that intense light will not make it beautiful."—Emerson.

Note the stagnant pool festering with corruption and reeking with miasmas; observe the foul scum upon its surface. Let a sunbeam fall aslant upon it, and behold, the miracle of the bow of promise! Not the glory of Solomon, nor the marvels of the chemist's dyes, nor the skill of the greatest painter can equal the exquisite purity and brilliancy of its coloring. The light of heaven, impinging upon its surface, shakes itself apart and reveals to the eye the inward qualities of its nature. Rushing straight from its source of pristine purity, it strikes corruption and is reflected undefiled.

It is small wonder that light has been the emblem of knowledge, of purity, of aspiration, and of redemption itself, since man learned to express himself in words. There is no moral or spiritual truth of which it is not a fitting symbol. Thus truth, like light, emanates from an infinite source; and though it may strike the foulest pool of lies and errors, it only shows the greater beauty on reflection. And, as the ugliest forms become beautiful when luminous, so the plainest face becomes glorious when illuminated by the light of truth and good will from within.

Few of us may possess the works of the masters of painting, but we can all make far more use of the greatest of all painters—Light—both in the physical and moral sense; and if we cannot become great sources of light ourselves, we can at least be more efficient reflectors, giving out to others in an even more beautiful form the abundance of light that we receive.

Let there be more and better light.

E. L. Elliott.

The Illumination of a Meeting House

By Charles J. Goldmark.

The meeting house of the Society for Ethical Culture of New York, recently completed, contains some features of interest to the illuminating engineer and the architectural profession.

It is a five-story and basement, fireproof building, located on the southwest corner of Sixty-fourth street and Central Park West, on a plot extending 81½ ft. on the avenue and 100 ft. on Sixty-fourth street, with three entrances on this street.

Fig. 1 shows an exterior view of the building.

The basement, fourth and fifth floors of the building contain class rooms, meeting rooms and offices for different organizations connected with the various activities of the society.

The main auditorium, which is to be used for the Sunday meetings of the society, occupies the first, second and third floors of the building.

It is 95 ft. wide and 76 ft. deep, the net floor area, with space for stairways and halls deducted, is 6300 sq. ft. The gallery floor area is 2300 sq. ft. The hall is approximately 43 ft. in height from the floor to bottom of transverse arches.

The ceiling consists of three barrel vaults meeting in the centre and two main transverse arches. The design of ceiling and general views of the interior of the wall are shown on Figs. 2, 3 and the cover design.

The ceiling and walls are wire lath and plaster, painted light grayish tan or ecru color.

FIG. I.—MEETING HOUSE, SOCIETY FOR ETHICAL CULTURE, NEW YORK.

FIG. 2.—VIEW SHOWING EFFECT OF ILLUMINATION IN THE GALLERY AND REAR OF FIRST FLOOR.

The pews and woodwork are fumed oak, natural color, with paneling on the walls about 10 ft. high. The floor is of cement, with dark green carpet, and same color cushions in the pews.

The daylight illumination of the hall is obtained from three large windows facing north, which extend from the ceiling to floor of gallery, and smaller windows under the gallery. The glass in these windows is imported English, double rolled cathedral glass, and thin white curtains are used to soften and cut off any excess of light.

The scheme for artificial illumination was worked out by the architect and the writer. Several different methods were studied; the final design was selected as best adapted to the architectural requirements and to obtain the desired result. The design of the ceiling clearly permitted of only one source of light, which should produce a mean illumination of about 1.5 foot-candles on the working

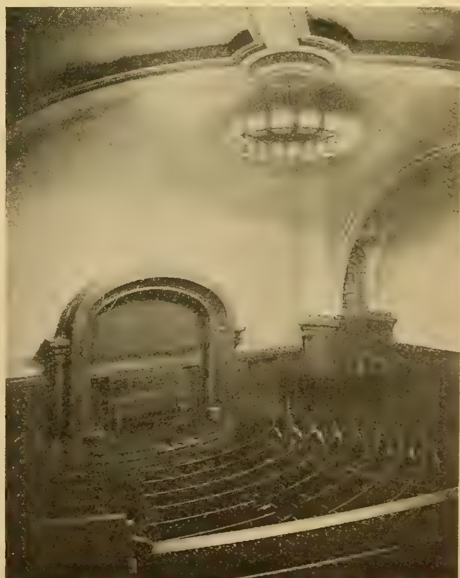


FIG. 3.—VIEW OF PLATFORM, SHOWING THE CENTRAL FIXTURE AND EFFECT OF ILLUMINATION IN FRONT.

plane, with sufficient uniformity to avoid unpleasant contrasts, which should also allow enough light to reach the ceiling and walls to illuminate same, but not brightly enough to be objectionable. No light sources were to show and no direct rays from any lamp should reach the eye. The color and quality of the light were to be such as to harmonize with and enhance the color scheme of the hall and the architectural design.

The architect's desire was to obtain the effect of a large ring of fire hung near the ceiling which should glow with a soft brilliant radiance.

With these conditions in view the fixture was designed. It consists of an annular trough having 16 sides or sections; the diameter across the fixture is 12 ft., the trough is 2 ft. wide and 18 in. deep, and the bottom and sides are covered with leaded glass made of imported English, double rolled cathedral glass, sand blasted on the outside.

In each section of the trough are mounted five plain tungsten lamps, in the centre of each section one 150-watt and around same four 60-watt lamps. The lamps are hung in a pendant position, and each one is equipped with a clear prismatic shade of the focussing type.

The fixture wiring provides for three different degrees of illumination, and is controlled from two different locations by means of remote control switches. No circuit in the fixture carries more than

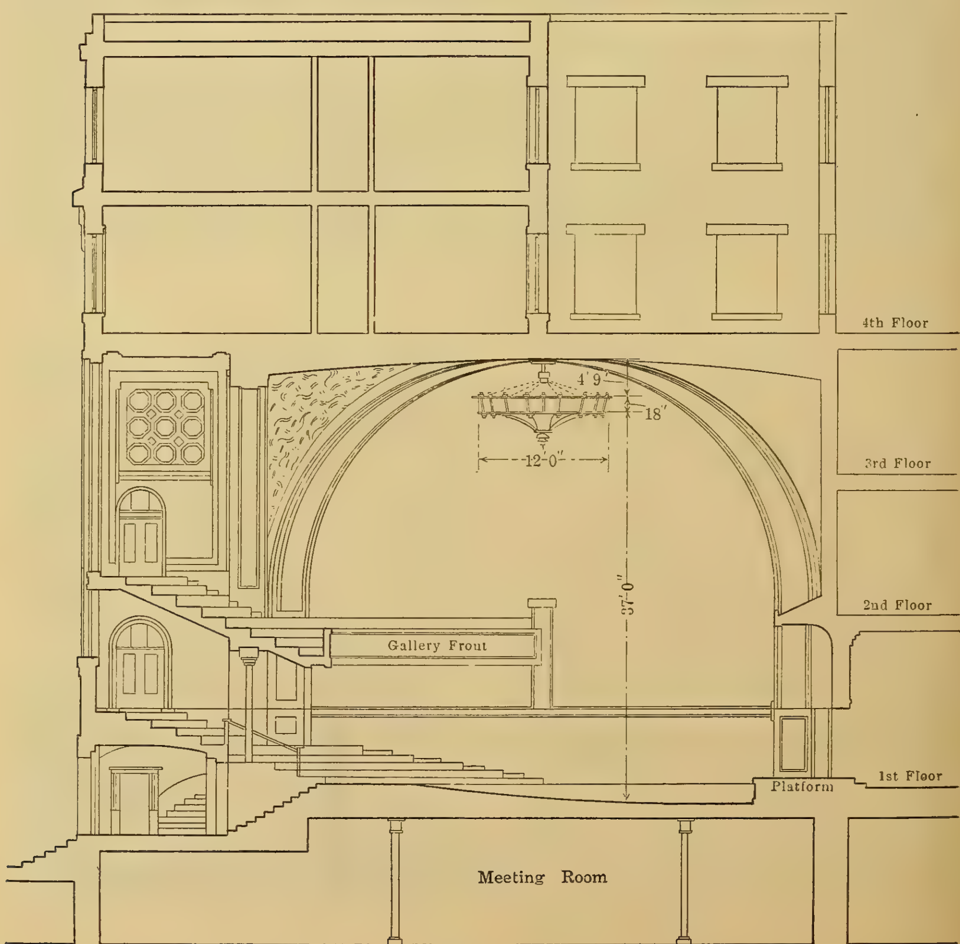


FIG. 4.

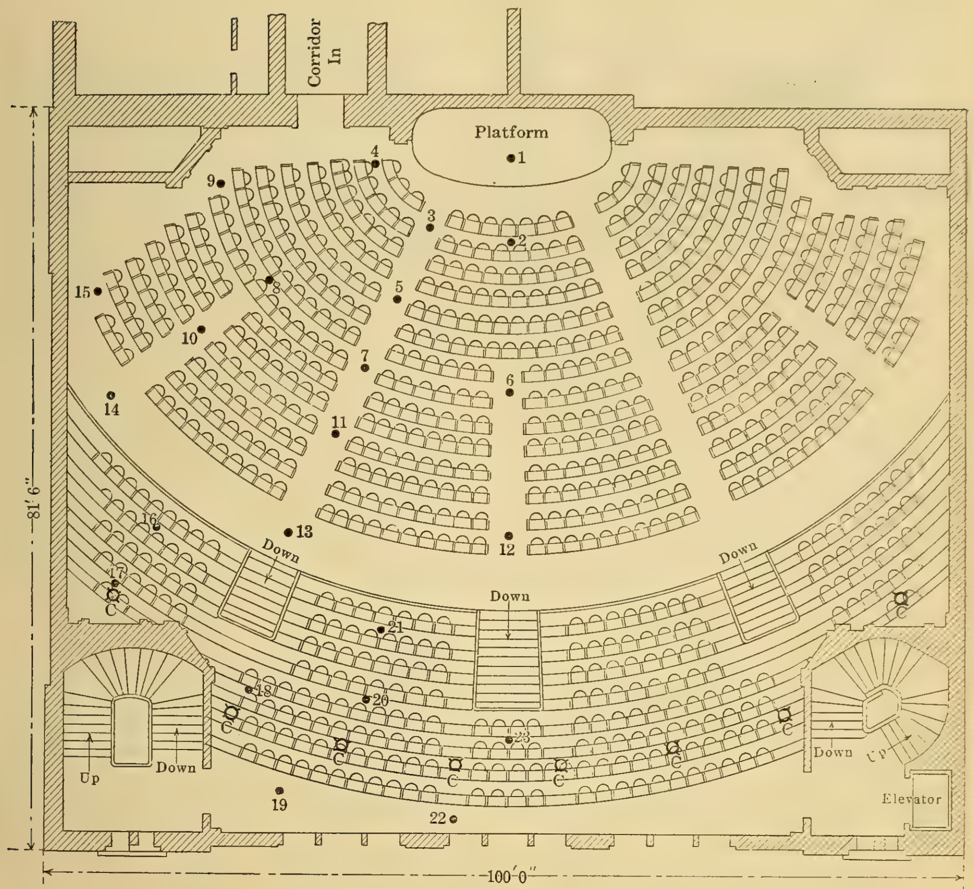


FIG. 5.

600 watts, and each circuit is protected by an individual fuse on the panel overhead, so that blowing of a fuse only affects a small number of lamps. Furthermore, the lights in the fixture are evenly divided on the two sides of the three-wire system, so that blowing of a main fuse on one side of the system would only extinguish one-half of the lights. With these precautions a double system of feeders for the lighting was not considered necessary.

The frame work of the fixtures is built of wood, supported by angle irons, and the whole is attached to the main iron supporting rod by means of heavy iron chains.

The fixture is arranged to be lowered to the floor by means of a triplex chain block.

The total wattage of the fixture is 6240, figuring the lamps at their nominal wattage ratings. Outlet marked "A," Fig. No. 6.

The other light sources in the hall are the fixtures in the ceiling under the gallery, which were kept far enough back to be entirely out of the line of vision. Outlets marked "C," Fig. No. 5. There are eight of these fixtures, consisting of sectional bowl fixtures, fitting close against the ceiling, the glass being the same kind as was used in the main fixture. In each fixture are mounted two 40-watt plain tungsten lamps. Total wattage of these fixtures 640 watts. From the ceiling above the gallery, intended to obviate the heavy shadow cast by the cross arch, are hung three box fixtures, made of the same glass as was used in the main fixture; in each

fixture there are mounted five 40-watt plain tungsten lamps. Total wattage of these fixtures 600 watts. Outlets marked "B," Fig. No. 6.

The general effect of the artificial illumination is very pleasant, the whole hall being filled with a soft, golden, well diffused flood of light, of sufficient intensity and uniformity, and of the desired quality and color.

Illuminometer readings on a horizontal plane were taken at stations marked by solid circles on Figs. 5 and 6, on which the electric outlets are also shown by the conventional signs. The readings were taken at an average height of 33 in. above the floor, the height of the back of the pews. The average height of light sources in the main fixture above plane on which readings were taken on the auditorium floor is 33½ ft., and in the gallery 15 ft.

Height of lamps under gallery above working plane is 9 ft.

Voltmeter readings were taken simultaneously, and from these the actual watts and lumens consumed were figured.

The total floor area illuminated is 8600 sq. ft., 6300 sq. ft. on the main floor and 2300 sq. ft. in the gallery. Total actual watts 7142, equal to .83 watts per square foot of floor area.

The mean illumination on the floor of the auditorium was 1.095 foot-candles; under the gallery, 1.072 foot-candles; gallery, .72 foot-candles.

Mean illumination of total floor areas .96 foot-candles. Effective lumens 8256.

Total lumens 55,720. Efficiency of light utilization 15 per cent. Lumens per watt 1.16.

Tests on the glass used in the main fixtures indicate an absorption of approximately 30 to 35 per cent.

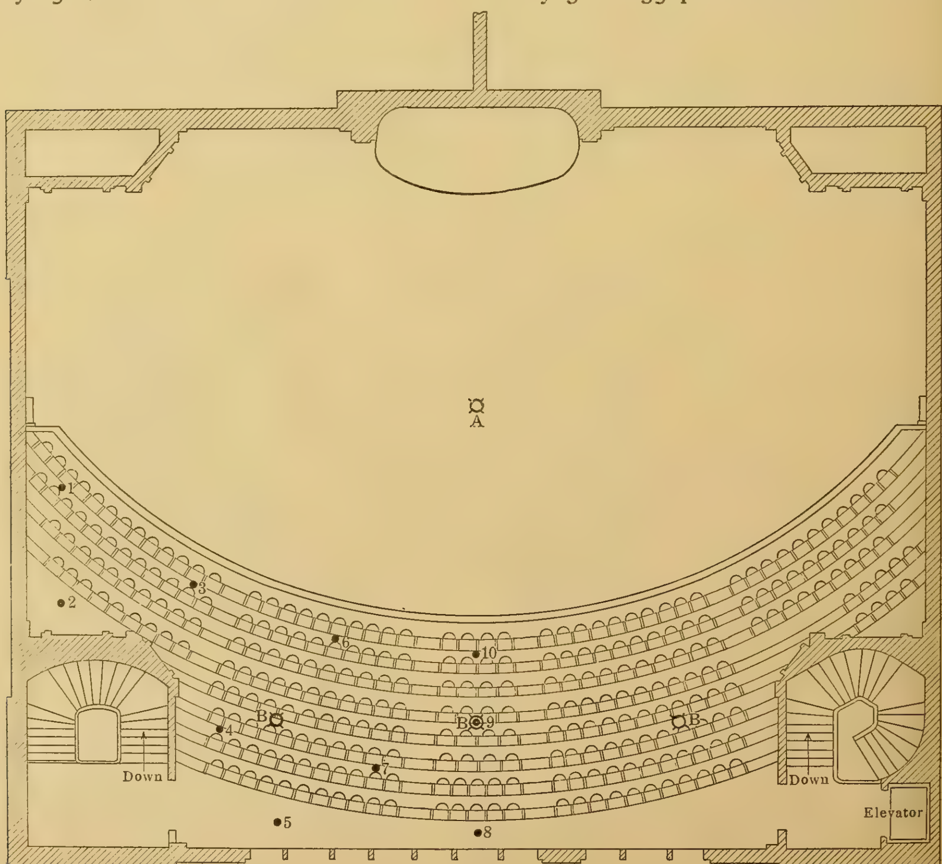


FIG. 6.

The calculated intensities on the floor of the auditorium under the main arches, without any allowance for absorption by the glass or reflection from ceiling or walls, averaged 2.17 foot-candles.

Measured intensities within the same area average 1.72 foot-candles, indicating that the absorption loss due to the glass is somewhat counterbalanced by reflection from the ceiling, this increase amounting to about 12 per cent. Acknowledgment is due to the architect of the building, Mr. Robert D. Kohn, for his cordial co-operation in the designing of the fixtures, and to the Engineering Department of the Holophane Company for assistance in determining the kind and location of lighting units and making the measurements of illumination.

ILLUMINOMETER READINGS.

Auditorium Floor.

Station No.	1—1.18	Foot-Candles.
"	"	2—1.68	"
"	"	3—1.37	"
"	"	4— .796	"
"	"	5—1.56	"
"	"	6—1.92	"
"	"	7—1.52	"
"	"	8— .978	"
"	"	9— .581	"
"	"	10— .809	"
"	"	11—1.28	"
"	"	12—1.43	"
"	"	13— .963	"
"	"	14— .593	"
"	"	15— .531	"
"	"	16— .706	"
"	"	21— .539	"

Means 1.095 foot-candles.

Under Gallery.

Station No.	17—1.00	Foot-Candles
"	"	18—1.12	"
"	"	19—1.26	"
"	"	20—1.033	"
"	"	22— .823	"
"	"	23—1.2	"

Means 1.072 foot-candles.

Gallery.

Station No.	1— .476	Foot-Candles
"	"	2— .51	"
"	"	3— .73	"
"	"	4— .586	"
"	"	5— .597	"
"	"	6— .915	"
"	"	7— .68	"
"	"	8— .652	"
"	"	9— .856	"
"	"	10—1.17	"

Means .72 foot-candles.

A Glaring Failure

The new Union Station in Washington, D. C., offered unusual opportunities to both the building and landscape architect for magnificent results, both by day and by night. While the former has been achieved to a degree, the latter is a most glaring failure, both literally and metaphorically speaking.

Following the prevailing " mode " in architecture the building is of a classic cast of features. Following the general custom in " the city of magnificent distances " the surrounding grounds are of generous extent. A street leads straight from the Capitol to the station, while other streets converge in the immediate vicinity. The grounds are laid out in the form of a large semicircle, having as its base the front façade of the building and a wide avenue around the periphery. Along this driveway there are double rows of tungsten cluster lamps at frequent intervals, and in the midst of these a single row of considerably higher posts, each bearing two magnetite arcs with clear globes, the tungsten lamps being provided with opalescent globes. The colonnade in front of the building itself is very dimly lighted from the arched roof by means of incandescent lamps in prismatic globes, which have been allowed to become excessively soiled.

The total result is faulty in every particular. Looking down from the Capitol the street appears to end in a miscellaneous jumble of blue and yellow lights, the magnificent outlines of the building itself being scarcely discernable past the brilliant light-sources. On closer approach the collection of lights begins to resolve itself into the excessive dazzling sources on the higher poles and the apparently unsupported clusters beneath them. The façade of the building shows

Photo by Waldon Fawcett

THE APPROACH TO THE NEW UNION STATION, WASHINGTON, D. C.

a dwarfed and unintelligible mass of masonry as seen by the eye in its attempt to look past the glaring light-sources. On passing through the semicircle and out of reach of the exterior lighting the comparatively dim illumination of the colonnade gives one the impression of going into a deserted castle.

The whole installation is an example of the perversion of intrinsically good lighting units so as to produce an actually disastrous effect. The use of two lights so distinct in color in such close juxtaposition is the first obvious error. If it was desired to use tungsten lamps for lighting the driveways the white flaming arc should have been used for lighting the front of the building. Such a combination properly co-ordinated would have brought out the architectural effect in brilliant and impressive relief against the black background of the sky, while the comparatively small incandescent units placed on low posts would have served to outline the foreground and still further enhance the architectural proportions. It is a pity that so fine a building, surrounded by such ample grounds, should be practically obliterated by night, to say nothing of the positive discomfort produced by the multitudes of dazzling and bewildering light units. Harmony, which is so much sought for by the architect and interior decorator, is by no means to be despised in exterior lighting. With all the numerous kinds and colors of light-sources now in commercial use, it is quite as possible to produce a conglomeration of light that is ugly and discordant in the case of exterior as in interior lighting. The size, height, color and arrangement of light-sources should be as skillfully planned in cases of the kind described as if an interior were to be illuminated. Furthermore, the question of glare must be equally considered. The tendency to revert to the intolerable condition existing in the days of the open arc with a clear globe—or none at all—should be discouraged in every possible way. Better light-sources should mean a step forward in the use of illumination, as well as in the mere production of light.

Idealism in Illumination Design

By Francisco Laurent Godinez and Albert Jackson Marshall.

In discussing the use of artificial light with an architect recently a remark was made that "with the broadcast circulation of promiscuous illumination data there has sprung into existence a rampant army of illuminating engineers—self-taught and self-crowned—their illumination designs partake of a subtle and ingenious expression of similarity which borders on the verge of monotony—let us pray that the saturation point has been reached! These cut-and-dried, ready-to-wear methods of illuminating engineers have contributed greatly in retarding the progress of illumination in this country—and have withheld its recognition from the critical artistic standard of the architect."

While the above is rather more forcibly than elegantly expressed, it nevertheless voices the opinion of a body of men without whose co-operation and support illuminating engineering will suffer.

It would seem that the day of regenerative methods in the treatment of artificial illumination is at hand and that the immediate future may indicate the advisability of superseding, in a measure, the terms "efficiency," "economy" and other expressions synonymous with "utilitarianism" by symbols representative of art, culture and progress.

Art Should Be Artistically Lighted.

In accordance with this idea, can we conceive of any more unsatisfactory condition wherein each and every lighting system in a community is practically an identity? Imagine the dull mediocrity of such a conglomeration, and consider the "atmosphere" which the lighting accessories of the barroom will create in the home. This, then, is why those who are engaged in the design of artificial illumination should constantly endeavor to infuse a spirit of individuality into their designs, and it is only by doing this that we may hope to attain an ultimate realization of our ideals.

The lighting of a picture gallery, where either statuary or paintings are exhibited, affords an excellent example of dogged persistence in adhering to time worn and antiquated methods of illumination, and that is why the authors have selected the following problem as one being worthy of analysis.

In solving problems of this class it must be borne in mind that statuary and paintings require absolutely different systems of illumination—either with natural or artificial light.

Where sculpture is on exhibition, diffused light must be avoided, since strong shadow contrasts are necessary in order to establish the proper relief effects in high lights. These are not obtainable with a diffused light, and a direct system of illumination must be employed.

Conversely, where oil paintings or water colors are displayed, either within or without glass, diffused light must be used. This is due to the fact that every artist, in the conception and execution of a painting, must first assume the light to emanate from some definite direction—the left, the right, or from above. His sense of perspective and shadow contrast is based on this hypothesis, and as the picture grows the high lights and low lights create at last that perfect tone or ensemble which is the distinguishing mark of genius.

Place this work of art on exhibition under a system of direct artificial illumination and study the effect. Shadows which should be subdued become lighter in tone, the delicately tinted horizon loses its exquisite tone and becomes simply a glaring, polished surface of paint by specular reflection. The whole sense of perspective is distorted and the observer is obliged to assume various positions in order to get even a general impression. Even with the most carefully planned system of direct illumination, with special allowance for the varying limits of the critical angle, it is impossible to avoid a juxtaposition of shadow contrasts and false perspective.

Limitations of Indirect Lighting.

One might assume that the indirect method of illumination would meet these requirements, but even if it were possible to utilize an opaque ceiling in studios, ex-

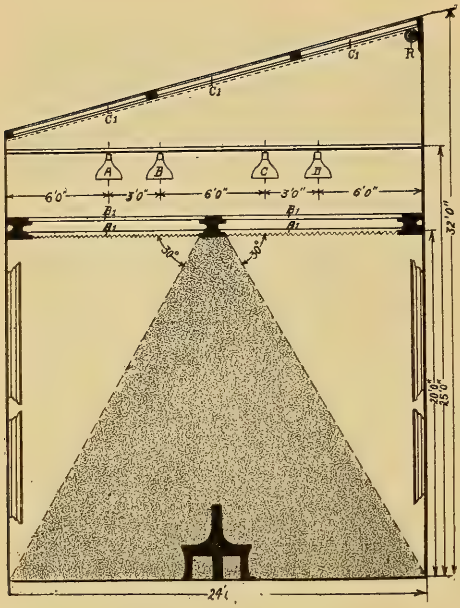


FIG. I.

perience has shown conclusively that with indirect illumination the imperfect diffusion beneath the suspended and inverted reflectors produces variations which obliterate detail—to such an extent that in a large ballroom in the West, equipped with this system, it is absolutely impossible to recognize the features of a person standing at a distance of 50 ft.

Aside from these objections, the architects prefer to omit fixtures of any character, and thereby nothing is in evidence to distract the attention of the eye.

Obviously, daylight plays an important part in such interiors, and one of the most difficult conditions to overcome is the proper combination of these two systems —the natural and the artificial light. In several instances artificial light-sources have been placed above false ceilings of ground glass and beneath the typical studio skylight. The difficulty with this arrangement has been, first, a wide variation in intensity on the studio walls, and, secondly, under daylight conditions, the projection of shadows by such reflector on the false ceiling.

How One Problem Was Solved.

Fig. 1 indicates a solution of this problem by the use of prism glass. The roof is essentially a skylight of the characteristic atelier type, fitted with panels of plane glass C_1—C_1. Beneath this skylight "R" is an opaque roller curtain, which may be drawn across the skylight, as indicated by the broken line. The installation of this curtain is important, inasmuch as when daylight is insufficient in intensity to illuminate the pictures properly, then such daylight should be excluded and the artificial light brought into use. The mistake should not be made of trying to "build up" the natural illumination by the introduction of artificial light. Use one or the other—never the two together.

The light radiators, A, B, C and D, are disposed as indicated, and are within secondary radiating surfaces of prismatic reflectors. While an opaque reflector with a silver surface would produce a higher intensity, its high initial cost, greater depreciation—due to age—opacity and the probability of casting denser shadows renders it unsuitable for the requirements.

B_1 is a primary diffusing plane of glass very lightly acid etched and supported by the "I" beam construction indicated in the drawing.

Directly beneath this primary diffusing plane is a secondary diffusing and redirecting plane, A_1, of prism glass. The prisms are specially calculated to give a distribution of light flux in a vertical plane, with the maximum at 30°, as shown in Fig. 1.

In Fig. 1 it appears that the light radiators are placed nearer the center of the room than the side walls, and this is done with reference to the law of inverse squares and the limiting position of the primary radiator referred to the prismatic plane surface. Experiments will be conducted to confine the maximum flux of daylight to the center portion, as is done with the artificial, so that a uniformity of illumination may be obtained on the vertical plane—namely, the wall on which pictures are located—as is the case with artificial light.

Without the diffusing plane, B_1, the daylight and artificial flux would impinge directly on the prismatic plane A_1, causing considerable specular reflection, as a result from the surface of the paintings on the side walls.

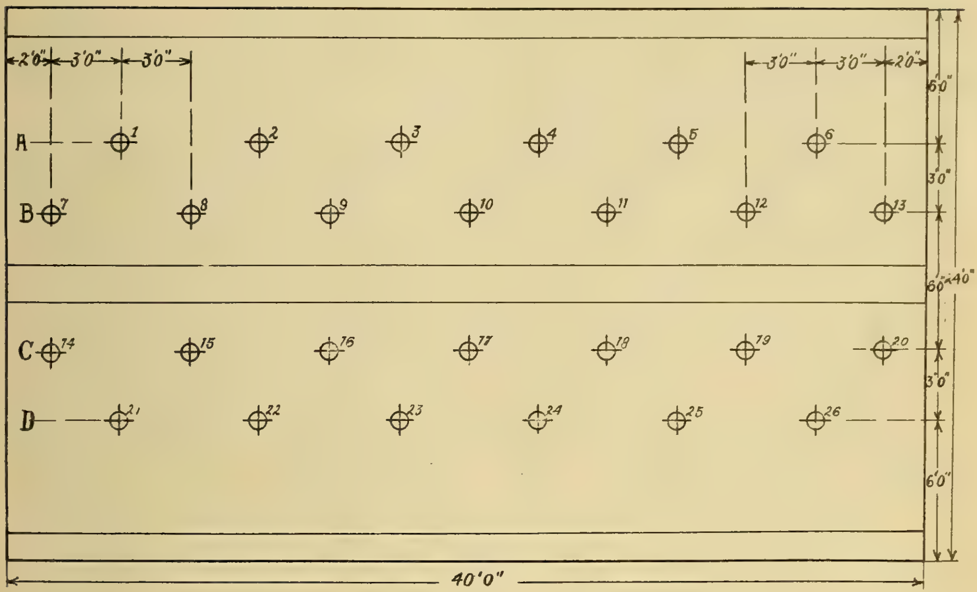


FIG. 2.

By the use of the aforementioned arrangement those portions of the room given over to the display of pictures receive the maximum light, while that part used by the observers is illuminated to a lesser degree. In other words, the light is directed to the object and not where it is not utilized. This system also has the advantage of having the direction of light coming from the rear, over the shoulder, as it were. The advantage of conforming the emission spectra of the natural and artificial sources within comparative areas is one which has received spontaneous recognition by several members of the Beaux Arts Société.

Fig. 2 shows diagrammatically the dispositon of the outlets within the area included between the skylight and the false ceiling of acid etched glass.

Light in the Sultan's Palaces

The Oriental ruler has always been famed for the magnificence of his establishments and his luxurious methods of living. Americans have come to covet the tapestries and rugs woven with such infinite patience and skill, and often with such rare blendings of color, that have for centuries been the common property of the Turkish and Indian magnate. The question must naturally arise, what other furnishings are used in connection with these masterpieces of the textile art and how are they illuminated by night? We showed some months ago a view in the vestibule in one of the Sultan's palaces. We present herewith three views of interiors which answer these questions to a certain extent. It is not surprising to find the candle still the principal source of light; and where labor is cheap at the best, and at the absolute command of the master of the palace, we are rather inclined to envy the Sultan his enjoyment of the "real article" instead of having to content himself with a lifeless imitation.

Fig. 1 shows the prayer room in the Dolma-Baghtche Palace. The illumination here is by a crystal chandelier bearing wax candles. The Sultan has traditionally drawn upon the resources of the

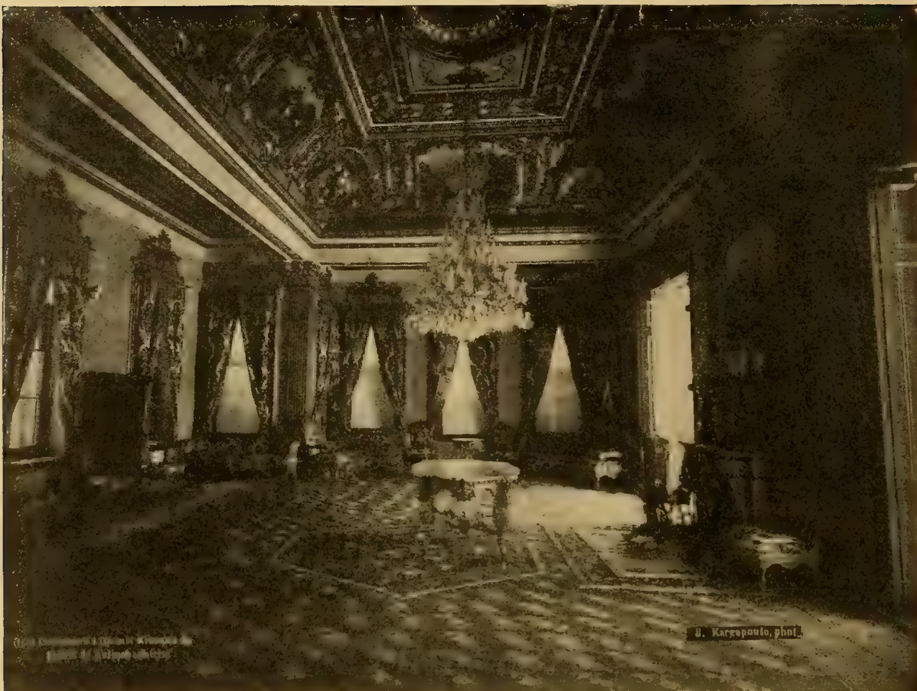


FIG. I.—PRAYER ROOM. THE DOLMA-BAGHTCHE PALACE.

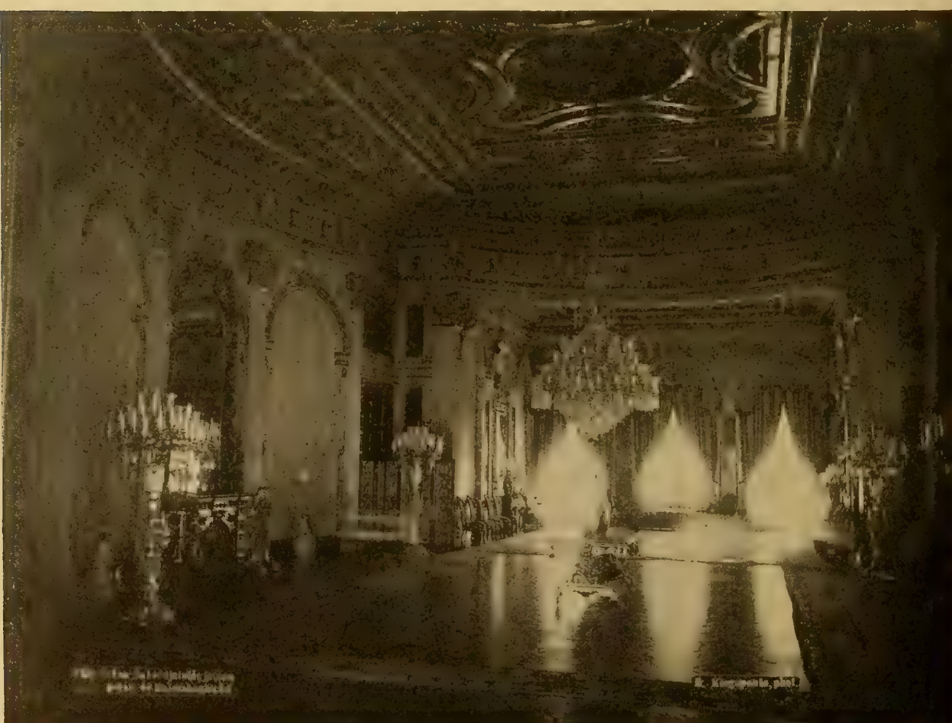


FIG. 2.—SALON. THE DOLMA-BAGHTCHE PALACE.

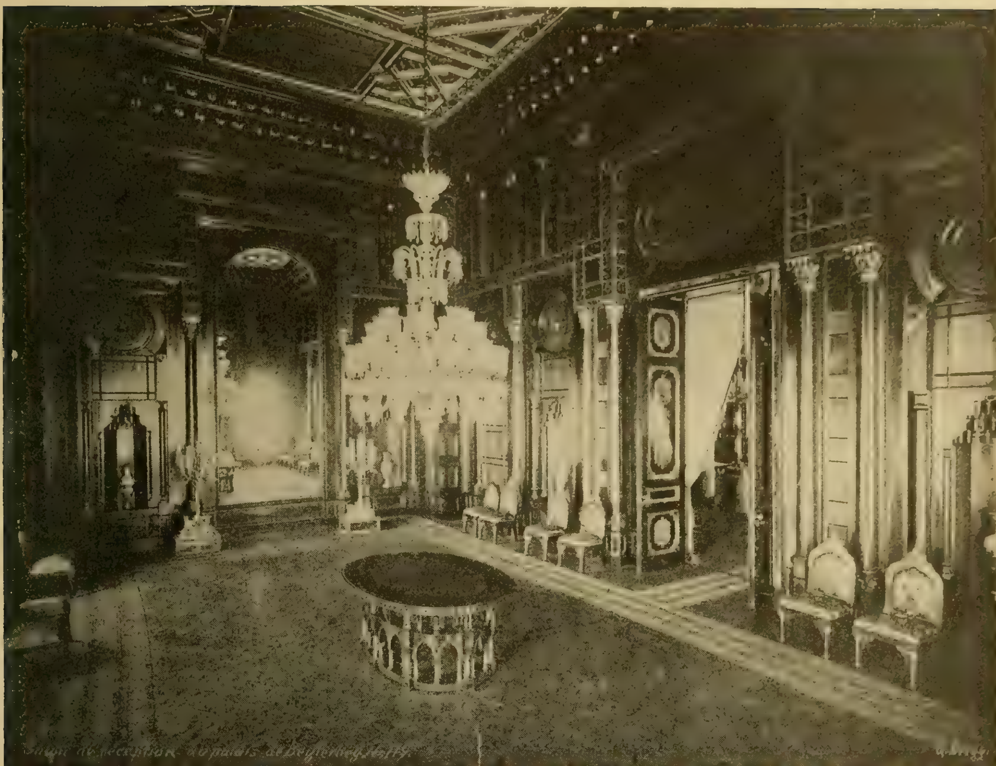


FIG. 3.—RECEPTION ROOM. BEYLERBEY PALACE.

world in the furnishings of his palace, and hence we are not surprised to find the lighting fixture in this case bearing evident marks of European manufacture.

Fig. 2 is a view of the salon in this palace. The central crystal chandelier in this case is supplemented by candelabra of the same material and character of treatment. The decorations of the room are distinctly French, and the lighting fixtures are undoubtedly from the same source. There is a remarkable degree of similarity in the lighting equipment of this room with that of our own White House, the chief difference being the use of the actual candle in the case of the Sultan's palace, and of more expensive and ornate fixtures.

Fig. 3 is an interior of the Beylerbey palace, which shows the distinctly Oriental style of interior decoration and furniture. The crystal chandelier still finds a place, but is given a treatment to harmonize with the decorations.

The Lighting of the Theater in the New Home of the Institution of Electrical Engineers (London)

By an English Correspondent.

Some interest has been excited among those concerned with lighting problems in London by the opening of the new buildings of the Institution of Electrical Engineers. This building has been purchased at a cost of £50,000 so that the Institution has now for the first time a home of its own, and an additional considerable sum has been expended on rebuilding a portion of the premises and redecorating. It had been previously mentioned that the Council of the Institution, in planning the lighting of the theater, had determined at all costs to avoid anything in the nature of glare, and it now transpires that the system is mainly of the indirect kind.

The room is about 50 ft. square, the walls being in unpolished mahogany. Round the top of the room there is a white carved frieze, illuminated by a series of two hundred and twenty 25-watt lamps; the consumption of energy from these lamps alone is therefore just about 2 watts per square foot. In addition to this, however, there is a central method of illumination. The center portion of the ceiling is composed of diffusing glass, which, in the daytime, admits daylight, but in the evening receives light from four mercury vapor quartz tube lamps, each consuming 350 watts.

Results of Illuminometer Measurements.

A series of measurements of the illumination in this room were recently made, and some of these are quoted in *The Illuminating Engineer* (London). The illumination over the ground area seems to be remarkably uniform. It is stated to be about 2 foot-candles, is secured near the president's desk, about 1.8 foot-candles over the greater part of the auditorium, and slightly less close besides the walls. On the other hand some people have urged that this success in securing uniformity is not quite what is wanted in a lecture theater and that the illumination near the president's table ought to be accentuated, so that the eye is involuntarily attracted toward the lecturer.

Some difference of opinion has also been expressed as to whether the method is, after all, the ideal one as regards its general effect on the eyes. It is true that the glare from naked filaments is avoided. Still, the uniformity of tint of the surrounding walls being of a monotonous ruddy tone, and the absence of any obvious lighting sources, produces a certain feeling of "something missing." This "flatness" is known as an accompaniment of indirect lighting and much doubt has been expressed in the United States regarding the propriety of purely inverted lighting systems. The idea is that the eye is not contented with a great expanse of uniformly illuminated surface, even if of moderate intensity; it demands the opportunity of resting itself by looking at objects of considerably different brightness. However, it may be pointed out that in the above case the surfaces exhibited to the eye seem to be very moderately illuminated and, in a sense, afford some scope of the kind advocated. The brightness of the actual walls is stated to be 0.3 foot-candles, while that of the illuminated frieze about 5 to 10, according to position.

Another feature which relieves this system from the complete flatness of pure indirect lighting is that the shadows due to the carving on the frieze help to liven up the appearance of the white surface and prevent its being too "dead." On the other hand, it has been suggested that the shadows, being cast *upward* by the concealed lights, are somewhat unnatural.

The Effect of Different Illuminants in Relation to the Total Result.

One very interesting measurement referred to in *The Illuminating Engineer* (London), may also be mentioned. In this journal the question has been raised in the past whether, when a mixed system of illumination by several types of illuminants which differ markedly in color is

used, the resultant illumination from the individual sources will "add up" correctly. In other words, if we have a combined system of lighting by incandescent and mercury vapor lamps, and measure the illumination actually produced by each separately, will the addition of these two figures give the actual illumination which is found to exist when both varieties of lamps are turned on? Some authorities have described experiments which tended to show that this was not the case. This we can quite believe to be possible at low illuminations, when owing to the struggle between the "rods" and the "cones" in the retina, the eye is in a very peculiar state. But at high illuminations one would expect the illumination to add up with fair exactitude.

This proved to be the case in the installation here described. The illumination due to the mercury vapor lamps alone was 0.5 foot-candles. The illumination due to the incandescent lamps was 1.6 foot-candles. The combined illumination from both lamps was slightly over 2 foot-candles. In the circumstances this is very fair agreement.

It is possible that some modification may be made in this installation, should it eventually be found desirable to bring a certain amount of local lighting into play. By some the general effect of the scheme might be considered almost spectacular or theatrical. The greenish rays of the mercury lamp, filtering through the latticed glass, give the impression of moonlight, and contrast in a rather striking manner with the brownish walls. On the other hand it must be remembered that the room is new and that the decoration scheme is probably not complete as yet, so that additions in this direction may furnish an improvement. Meantime it is certainly something for the avoidance of glare to have been insisted upon.

Architectural Considerations

By Albert Jackson Marshall.

Part II.

Let us consider briefly, and as impartially as possible, the relation which the architect and the engineer, in so far as lighting is concerned, bear to each other.

Generally speaking, an engineer has but comparatively little appreciation of the value of art—that which at once gives pleasure and rest; which is soothing to the mind and comforting to the body. His training has been generally along lines calculated to fit him for securing efficient and economical results, and imparting the means to employ to attain such ends; and he is thus very likely to consider it a piece of useless extravagance to expend a portion of an appropriation for the softening and embellishment of his hard, practical work. However, he is not to be censured for his lack of appreciation of the beautiful because of his training and associations, as long as he confines his efforts to lines of work that may not demand the use of esthetic principles.

The artist, on the other hand, must ofttimes be held down to Mother Earth by causing him to understand that utility, in the great number of cases, must be represented in his work. There are, of course, instances where utilitarianism need not be largely represented in the artist's efforts, any more than esthetic features need be largely reflected in the efforts of the engineer; but there are other instances—and they are numerous in the utilization of artificial light—that *must* receive a mixture of such efforts in happy proportions. And here is where the discord arises; the engineer, on the one hand, attempting to place economical results far in the foreground and esthetic effects just as far in the rear; and the artist, on the other hand, attempting to subordinate efficiency and economy to that which, by his education and associations, he naturally holds most dear. In a measure both are right; they are both holding out for principles which they have been taught to appreciate. It does not take a genius to see that if their

respective talents were exerted toward a common end the results of such co-operation could not help but be of the highest order.

Inasmuch as the engineer has been largely responsible for the present awakening in lighting matters, we find that the recent theories and methods advanced are concerned more with scientific formulae than with esthetic feeling. For the valuable suggestions and assistance that the engineer has offered he should be given due credit; but simply because he has given such assistance is no reason why the utilization of artificial light should be regarded as a *purely engineering* (mechanical) *problem*—which *it is not.*

Appreciation of Good Art Increasing.

It is evident that there is a decided tendency for the people of this country to pay greater attention to the more satisfying, beautiful things. This change of feeling can be easily detected by noting objects which are now being offered for sale in the average store, and how merchants are attempting to display their merchandise so that it will afford an example of what can be accomplished if used in similar manner in the home. Not only do we see a change for the better in the appearance of the homes of the people, but we also see the effect of such an educational movement in the demand for a better style of public buildings, more beautiful streets and parks, and more artistic public lighting. I believe that the architect appreciates the need of engineering more than the engineer appreciates the value of esthetic results. I have often heard the architect criticised as a bigoted, conceited individual; but I believe that the average engineer, if he is carefully diagnosed, will quite as often be found to be suffering with a chronic case of megacephalis. The engineer is inclined to assume that, because his figures and results deal with tangible quantities, while the architect deals with ideas and feelings, his opinions should take precedence. If the situation is more or less strained in ordinary lines of work, consider what are the complications in the use of artificial light, where not only the architect and the engineer must be considered, but the physicist, the oculist and the psychologist as well.

Engineers Must Show Their Appreciation of Art by Their Work.

Something more than mere words is necessary to convince the architect that you are sympathetic, that you desire to co-operate; you must actually *have* the "feeling," and be sincere. A veneering of the formulae of art can rarely be put on sufficiently thick to withstand the scrutiny of the architect. The essential thing, therefore, is to study, throw yourself into the work as much as possible; to show your sincerity by admitting your lack of knowledge; you will find that the people whom you have been prone to condemn are ready and willing to impart information, which, when you understand it, will enable you to obtain results which would otherwise be beyond your reach. For me to attempt to outline a course of instruction in this important work would be presumptuous, to say the least; the general matter involved is so broad and deep that masters have scarcely achieved its proper presentation. I can and do, though, most earnestly advise that we learn to develop that which is ordinarily termed "good taste," and to seek definite knowledge from the various books on the subject, which may be found in any public library.

A Plea for Co-operation.

In closing this article I most earnestly plead that greater attention be given to the esthetic features entering into the utilization of artificial light, and that the engineer endeavor to see the reason for the ideals which the architect sets up, and which the better class of decorators, designers and fixture houses are attempting to materialize; that the architect will, in having the efficient and economical features presented to him in a proper manner, see their value and incorporate them to the proper measure in his work; that those who are interested in the general study and dissemination of the principles involved in the intelligent use of artificial light will appreciate the necessity of having the architect and his associates represented in such movement; and that the man who is selling lighting

equipment will also understand that this article is for his attention as well; for behind the thoughts herein expressed lies the ever present commercialism. So many salesmen feel that an appreciation of artistic effects may be all well for the estheticist to entertain, but that his work is to sell goods. If he for a moment could but realize that if he would appreciate the value of "effects," that not only would he be able to sell *more* and a *better* class of equipment, *with resultant greater profit,* but that he also would have a sales talking point beyond the commonplace, threadbare price considerations: there is an intensely practical side to this idea.

FIG. I.—NIGHT ILLUMINATION AT THE COLISEUM DURING THE RECENT ELECTRICAL SHOW.

Illumination at the Chicago Electrical Show

Without doubt there is no other feature which attracts the public to the various electrical shows held in the country each year so much as the illumination. Special efforts are made to produce original and striking effects for each show, and the results are well worth the public attention which is accorded them.

The illustration gives a fair idea of the illumination of the last show at the Coliseum in Chicago, January 7 to 21. As will be seen, no spectacular effects were aimed at. The mistake of putting up brilliant lights until the eye is simply dazzled out of countenance has been wisely discarded. A general effect of brilliancy without glare and of a quality that will enable the visitor to comfortably and clearly see all that is on exhibition is more to be desired than a mere "blaze of glory" that may produce a moment's wonder. That this object was attained is sufficiently indicated by the photograph.

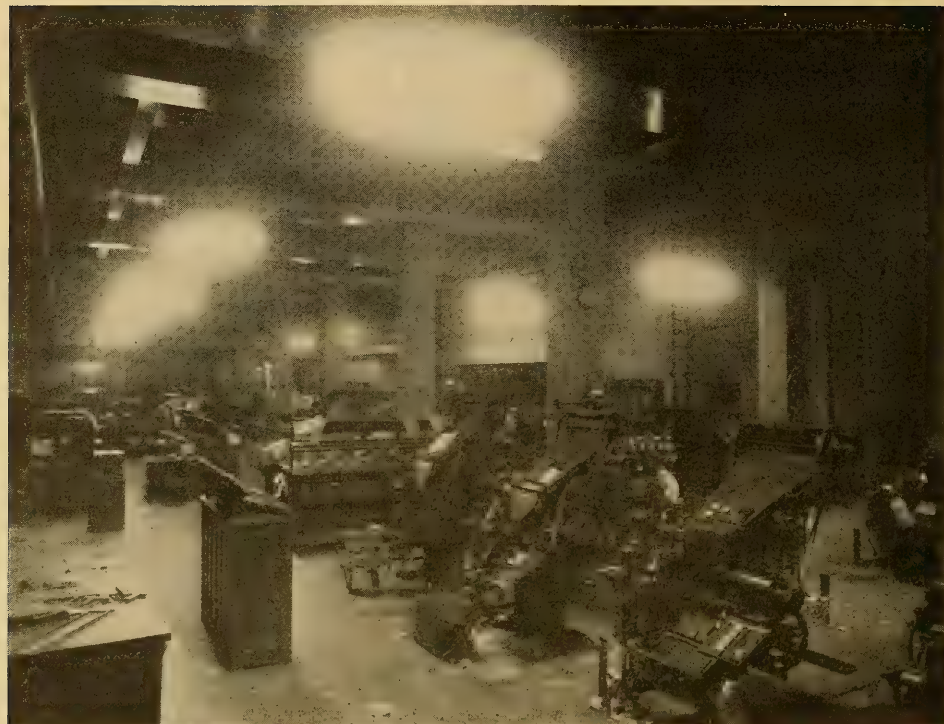


FIG. I.—COMPOSING ROOM, EVENING "BULLETIN," PHILADELPHIA, SHOWING EFFECT OF COOPER HEWITT ILLUMINATION.

The Illumination of a Newspaper Printing Office

By W. A. D. Evans.

"In Philadelphia Nearly Every One Reads the *Bulletin*." This advertising slogan apparently contains a much larger measure of truth than most advertising claims. It takes both money and brains to run a modern daily newspaper. Generally speaking, to the extent which the latter necessity is supplied by the paper, the former will be supplied by the public. The physical assets of a newspaper are therefore a much more accurate gauge of its worth and standing in the community than in the case of individuals. The handsome building of the *Bulletin,* which is so conspicuous an object at night by reason of its beautiful decorative exterior lighting, is in its way an affidavit as to the truth of its slogan. Whoever has seen the building at night will remember two distinct impressions: the unusually handsome outlining of the tower and the row of windows in the top floor, with their vividly contrasting light of the peculiar peacock-blue color, which denotes the Cooper Hewitt lamp.

A newspaper office has one celestial quality, in spite of the fact that it posseses one or more "devils"—there is no night there; it is the one case of absolutely "continuous performance." The regular necessity for night work, coupled with the exceedingly trying character of much of this work upon the eyes, necessitates special care in the selection and use of lighting units, which will conserve vision to the greatest possible extent. It is impossible to conceive of any work in which the opportunities for error are so numerous,

FIG. 2.—PRESS ROOM.

FIG. 3.—SHIPPING DEPARTMENT.

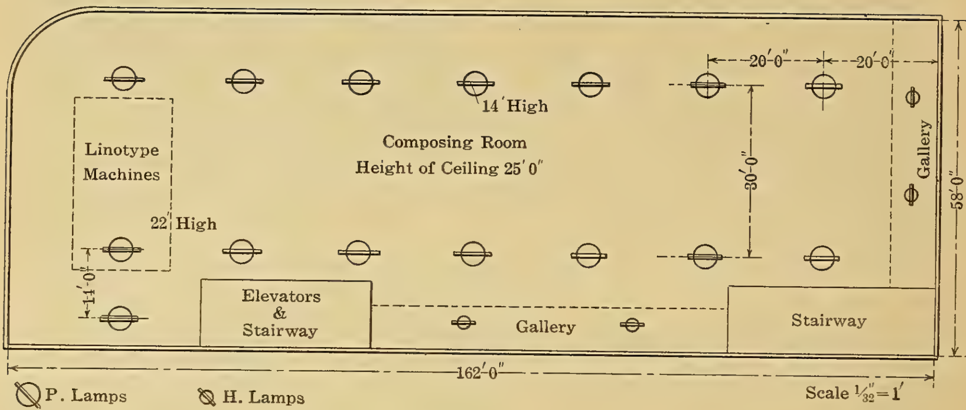


FIG. 4.—FLOOR PLAN. COMPOSING ROOM.

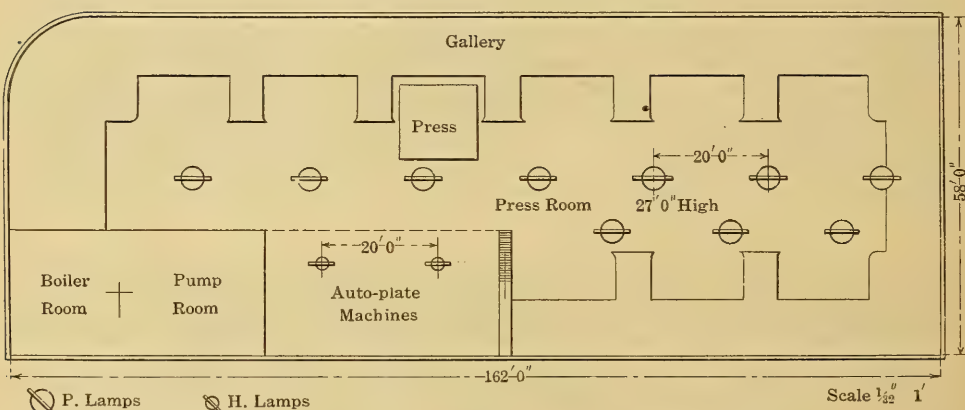


FIG. 5.—FLOOR PLAN. PRESS ROOM.

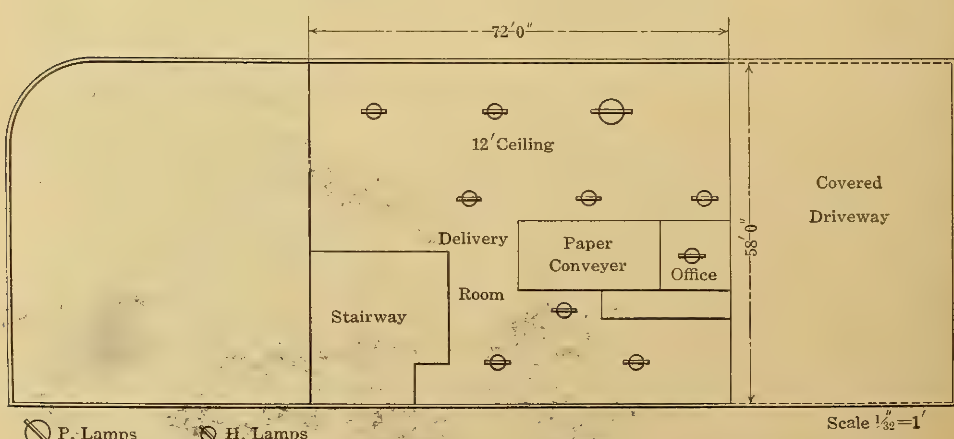


FIG. 6.—FLOOR PLAN. SHIPPING DEPARTMENT.

or where mistakes may be more fatal, or where eye and nerve strain would be so direct a handicap as in the work of publishing a daily paper. Type setting, whether by hand or machinery, is notoriously hard on the eyes. In modern practice the type is nearly always practically new, and consequently possesses a highly reflective surface. The "copy" is of all possible degrees of legibility from faint penciled scrawls to plain print. The type setting machines turn out "slugs" (lines of type cast in one piece) of glittering, burnished metal, generally with fine letters, which must be read by the operator.

The general requirements of the illumination may be summed up in the following: *the greatest acuity of vision with the least strain upon the eyes.* Color distinctions do not enter into the problem in any way. The now well-known property of the bluish-green light of the mercury vapor lamp, invented by Mr. Peter Cooper Hewitt of accentuating acuteness of vision while relieving the eye of the irritation of red rays, peculiarly fits this light-source for meeting the requirements. It is not surprising, therefore, that this form of lamp has found general favor among printers and publishers, among which number is the newspaper which "nearly every Philadelphian reads." A detailed description of the installation will be of interest to publishers and illuminating engineers.

The composing room is on the ninth floor, a plan of which is shown in Fig. 4. The lighting installation here consists of 15-type P and 4-type H lamps. Ten of the type P lamps are over the make-up and type cases, and extend the length of the building at 20 ft. intervals. The lamp tube is 14 ft. from the floor, with the exception of the two lamps over the linotype machines, which are 22 ft. high. The 4-type H lamps are used under the galleries simply to help out the general illumination; the height of these is about 10 ft. The room is 58 x 162 ft., with a 25-ft. ceiling. The consumption of current per square foot of floor area is .72 watts.

A night photograph of the room is shown in Fig. 1. The exposure of this photograph was very short, as is proven by the operators appearing in the photograph, with very little evidence of motion. The uniformity of the illumination and the sharpness of detail and absence of black shadows is, however, apparent.

Going from top to bottom, the press room is situated in the basement, a plan of which is shown in Fig. 5. It is lighted by 10-type P and 2-type H lamps. A gallery, extending nearly all the way around and between the presses, serves as a storage room for paper in bulk, and also as a foot-board for the presses themselves. This gallery is 7 ft. 6 in. from the main floor, and is so low that incandescent lamps are used on account of lack of head room. These are placed rather far apart and used only for general illumination. A portion of the interior is shown in Fig. 2. On one side of this floor is situated the stereotype, boiler and pump rooms. Two-type H lamps placed 16 ft. high illuminate the stereotype room, while the type P lamps in the main portion are attached direct to the ceiling, which is 17 ft. high. The illumination is all that could be desired, the smallest details of the presses, even though in comparative shadow, being plainly discernible.

The delivery and shipping room is located on the first floor, a plan of which is shown in Fig. 6. The room contains large tables for the wrapping and marking of bundles of papers, which are delivered from the press room by a chain conveyor. A covered driveway is situated at the rear of this room under the second floor, and the illumination from the room itself through the glass partition at the end is sufficient to light this space. The room is 58 x 72 ft. in the clear, with a 12-ft. ceiling, to which the lamps are directly attached.

A photograph of the room is shown in Fig. 3.

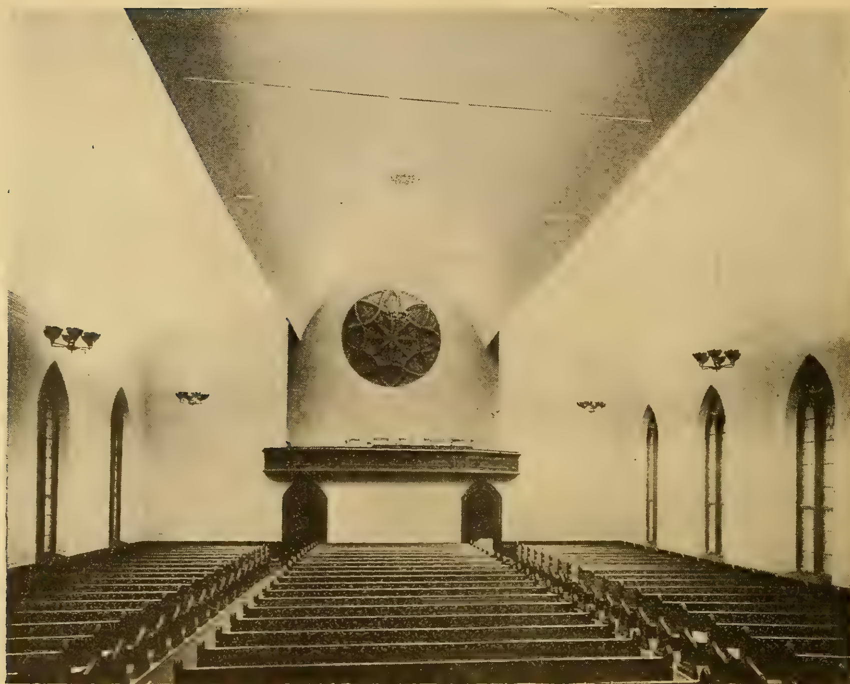


FIG. I.—CHURCH LIGHTED BY INDIRECT ILLUMINATION, ROME, N. Y.

Modern Church Lighting

I.—From the Pastor's Point of View.

By Rev. Alfred E. Alton.

When for the first time in your life you step from a dark street into an auditorium which is flooded with mellow light and yet not a single glaring bulb in sight to show you the source of the light, the sensations you experience are very pleasing. If your eyes are a little weak you find as you walk into the room that they are not instinctively half closing themselves for protection against the usual attack made upon them by the hosts of dazzling globes, for there is no such an array there to smite them. As you walk down the aisle you observe that as at noon on a summer's day, the light is so thoroughly diffused that no shadow is cast. You go into the farthest corner of the room and discover to your surprise that you can see there as well as in the center; you take up a book, look at the print and see that it is as readable as in the daylight. Then you look up to where the chandeliers, hiding within them from view the high power globes, are sending their rays up to the ceiling from which they fall softly everywhere, and find yourself saying, " This is a beautiful light."

Last summer one of the members of our church presented the trustees with a sum of money sufficient to enable us to do what churches everywhere are doing: arrange our auditorium along those lines which twentieth-century knowledge declares make for comfort and health of the men and women who worship there. For modern science has of late come up to the help of the clergy to show that if people fall asleep at the morning service it may be that the sermon offered by the minister is not the cause, but rather is the blame to be placed on the janitor for the poor quality of the ventilation he supplies.

Another stage in the evolution of church affairs is eliminating the germ breeding carpet in favor of the more sanitary hard wood floor. And now here comes the eye specialists to point out that not the second sermon of the day, but the bad lights, are the cause of the headaches with which some of the faithful go from their church to their homes!

The committee of business men appointed to have charge of the renovation of the interior of our church had no difficulty in finding a contractor to lay the kind of hard wood floor we wanted; nor was there any deal in securing artists to properly redecorate our walls and ceiling. But when the committee began to consider the proposition of lighting they found themselves in difficulty. One thing they were agreed upon: the old system that had been so long in vogue would not do. Low-hanging chandeliers running down both sides of the church and wall lights placed over the pulpit made a lighting system that rendered it impossible for people with weak eyes to sit in our church at night save with great discomfort. Even men and women, whose eyes are strong, had found it unpleasant to sit in the pews and look toward the pulpit with those strong light rays burning their way into the delicate organism of their eyes. There was but one alternative that could be thought of, however, and that was to put high up on the ceiling rows of high power lights. Several objections to this method were noted, but we could think of no better one. Fortunately for us, however, before we signed the contract, a friend called our attention to a system by which the glare of the lights themselves was entirely hidden, while their rays were diffused softly through the whole room.

"Where can we see this system in working order?" our committee inquired.

"It is a new thing," our informant replied, "and I know of no place nearer than Chicago where it can be seen."

Just at that time it happened that some of us happened to see in the *Literary Digest** a few pictures of the indirect illumination method as used in the Capitol building at Washington. It seemed to us on hearing and reading about it that this system would work well in our church. We found, on inquiry, that the

* Reprint of an article in the July, 1910, issue of THE ILLUMINATING ENGINEER.

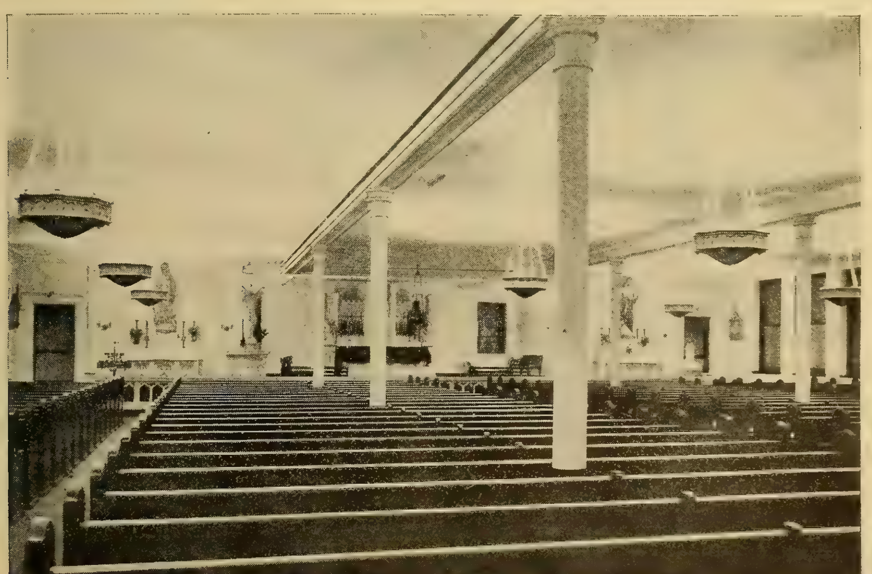


FIG. 2.—CHICAGO CHURCH LIGHTED BY INDIRECT ILLUMINATION. NOTE THE GOTHIC TYPE OF FIXTURE.

expense of lighting by this method would be but a slight increase over the old way. The plans were submitted by experts for properly lighting our church with this system, and the committee voted to install it.

Now it is not to be denied that if a thing pleases everybody in a large company of people that thing is able to withstand a hard test. That is the test this system has met and passed successfully here. Our people are not only satisfied with it but very much pleased. The light it gives us, with its soft diffusion and quiet efficiency, seems peculiarly well adapted for church use.

Said one of the aged members of our church to me the other night after the service: "The time may come when a glaring light bulb in a house of worship will seem as much out of place as though some one should shout aloud a coarse word."

II.—FROM THE ILLUMINATING ENGINEER'S VIEWPOINT.

By Augustus D. Curtis.

The illumination of a church with modern light-sources is generally admitted to be one of the most difficult of all lighting problems. In a review of the subject in these pages by the editor, in which a large number of examples were critically examined, there was not a single case in which the system was given entire approval, either the hygienic or the esthetic principles or both being more or less severely transgressed.

Sleeping in church has been a butt for profane jokes for time immemorial, and it is said to be a matter of record that a bequest was made a century or two ago, the income from which was to pay for the services of a person to watch the congregation in a certain church and to awaken those who might have fallen asleep by giving them a gentle prod with a stick. Undoubtedly weariness after a hard week's work, aggravated by a too philosophical discourse, induces a condition peculiarly favorable to somnolence; but the fact is now equally well established that eye-strain produced by ill-considered illumination has a marked tendency to produce the same effect. Very possibly the natural instinct to close the eyes for protection has something to do with this feeling of drowsiness, for it is a common experience that keeping the eyes closed is an effective means of inducing sleep.

On the other hand, constantly looking at a bright object such as a light-source may undoubtedly produce somewhat the same effect, this being in line with the means frequently used for producing the hypnotic state. Whether constantly looking at a bright light-source may not induce a certain degree of autohypnotism in the observer is a question well worthy of scientific investigation.

Putting aside these more or less speculative problems, it is a matter of practical, everyday knowledge that strong light-sources in the field of vision are decidedly uncomfortable and unhygienic to the visual organs, and if there is any time or place in which the mind should be unhampered by nerve strain it is in church during the time of worship.

From the artistic or architectural point of view direct lighting has several objec-

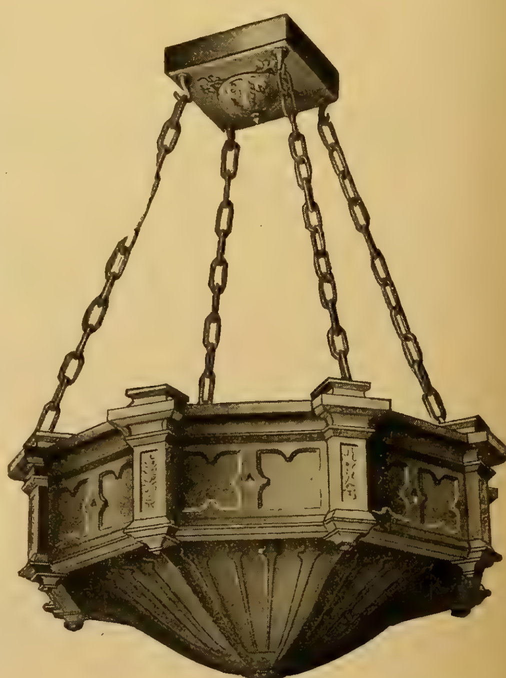


FIG. 3.—TYPE OF GOTHIC UNIT USED IN A CHICAGO CHURCH.

tions. Unless arranged with consummate skill it produces false shadows and high lights which more or less distort the decorative or structural features, sometimes to the extent of entirely reversing the effect intended.

Again, it is well known that light-sources in the line of vision make it all but impossible to clearly distinguish objects beyond them. It is a common case for the lights of a church to be so arranged as to prevent the face of the pastor or speaker being clearly seen, and as the facial expression is one of the chief elements in the personality which makes the delivery of a sermon more forceful than its presentation in printed form this defect is a serious one. This fact is fully recognized in theatrical practice, in which not only are all light-sources removed from the direct field of vision but the strongest possible light from a concealed source thrown upon the subject from the front. As the Rev. Mr. Alton well says, science has shown churchgoers how to improve the conditions of their places of worship quite as much as it has contributed to purely secular or commercial advantage.

There would seem to be no question as to the advantages of the indirect method of illumination in the case of churches and auditoriums, for by this means alone can a generally diffused and soft illumination be produced which is at once restful to the eyes of both speaker and audience, while at the same time preserving the architectural and esthetic effects of the interior.

A description of the details of the installation in the church of which the Rev. Mr. Alton is pastor will be of interest to illuminating engineers. A general view of the interior is shown in Fig. 1. The ceiling is of rather peculiar structure, a tunnel vault running lengthwise of the building, with very flat Gothic arches on the side. The room is 52 x 77 ft., with a floor area of 4000 sq. ft.; the height to the lower part of the ceiling is 26 ft. There are seven indirect lighting fixtures, each containing either 60 or 100 watt tungsten lamps. The total wattage is 3600, giving a wattage per square foot of 0.9. The fixtures are suspended 9 ft. from the ceiling. The average illumination is approximately 2.5 foot-candles, which is practically one foot-candle in excess of that usually found in churches. The chandelier type of fixture used in this case makes an inexpensive installation, the total cost not exceeding $250.

The cost of operation with all the lights on is 54 cents an hour. By reasonable economy in using the lights it has been found that the monthly bill is not materially greater than when gas was used.

Fig. 2 is an interior of the Church of St. Thomas Aquinas in Chicago. In this case more decorative fixtures have been installed, a special Gothic design being used, which is shown in Fig. 3. The absolute uniformity and absence of glare are clearly exhibited by the photographs, of which the illustrations are exact reproductions.

FIG. I.—OFFICE LIGHTED WITH INDIRECT LIGHTING FIXTURES, USING LINOLITE TUNGSTEN LAMPS.

Indirect and Special Illumination From a Tubular Source of Light

By William S. Kilmer.

I.—Office Lighting.

The problem of office lighting has probably given rise to more general discussion and serious differences of opinion than any other problem in illuminating engineering. There are three methods of solving the problem: direct lighting by individual lamps; indirect lighting by reflection from the ceiling; and general illumination by some of the usual methods. The indirect method has been generally sustained on hygienic grounds, but has often been discouraged by illuminating engineers, chiefly on account of alleged inefficiency. This latter objection may have had considerable measure of truth before the introduction of the tungsten lamp; but in view of the economies produced by this light-source, which is equivalent to more than cutting the current cost in half, the advisability of utilizing some of this efficiency in securing the best working conditions for the eyes is a proposition that needs no argument.

The problem in the present case consisted of an office room, the floor plan of which is shown in Fig. 2. The floor contains 1656 sq. ft. The ceiling is finished with a matt white coating, having a coefficient of reflection of .80. The side walls are in light buff, having a reflective coefficient of approximately .55.

The construction of the lighting fixture is well shown in the photograph, Fig. 1. Each arm is supplied with one 25-watt tungsten linolite lamp, with clear bulb, having a mean spherical candle power of 15.7, the reduction factor being slightly higher than the ordinary low wattage bulb lamp. The reflector is of sheet brass, the reflecting surface being aluminum coated, giving diffused reflection, and is of such shape as to confine a large percentage of the light within the 45 degree zone either side of the vertical, the maximum intensity within this zone being 62 candle-power.

Illuminometer measurements made on a plane 30 in. from the floor show an average value of 2.8 foot-candles, with a maximum of 2.85, and a minimum of 2.7. This variation is perceptible to the eye, and affords a means of rest, as the eye soon becomes weary when subjected to a perfectly uniform illumination. The specific consumption is 0.966 watts per square foot, which is lower than the majority of direct lighting systems.

The desk portables which are shown in Fig. 1 are used only for special occasions, as when individual bookkeepers wish to do night work without the use of the indirect system.

II.—Type Rack Lighting.

The proper illumination of a printer's type case is a matter of great importance with relation to its effect upon the quality and quantity of work turned out. Typesetting is an unusually trying work upon the eyes, owing to the reflecting character of the type, and the sharp focussing required by the eyes. It is needless to say that any exposed light-source, even though well diffused, would be annoying.

The method shown in Fig. 3 meets all these objections, besides furnishing the positive conditions most favorable for the

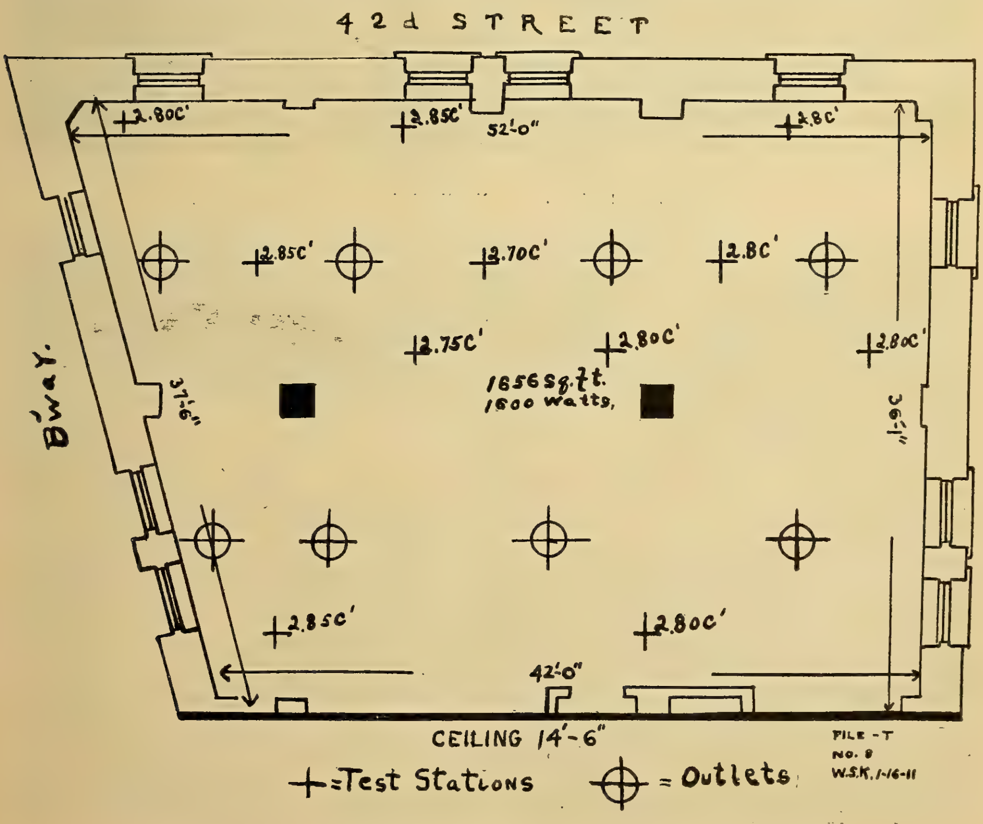


FIG. 2.—FLOOR PLAN OF OFFICE, SHOWING UNITS AND TEST STATIONS.

FIG. 3.—EFFECT OF ILLUMINATION ON THE COMPOSITORS' RACK.

FIG. 4.—VIEW SHOWING GENERAL EFFECT OF NEW SYSTEM OF ILLUMINATION.

FIG. 5.—THE EFFECT OF THE ILLUMINATION ON THE STONES.

work, *viz.*, a uniform illumination from a concealed source, so diffused as to prevent any direct reflection from the type. The lighting unit consists of a continuous section of 25-watt tungsten linolite lamps with a metal reflector giving an extremely broad distribution of diffused light concealed in a reflecting trough having a matt-white surface. Practice shows that the theories set forth are sound, the compositors having found that the illumination is all that could be desired. Figs. 4 and 5 show the general effect of the illumination; also a section of the stones.

A Comparison of Gas and Electricity for Industrial Lighting

By J. H. Campbell.

In order to compare, economically and otherwise, the most modern gas and electric lamps for use in large industrial plants a test was recently carried out in one of the departments of a large automobile factory.

The electric arc was considered unsuitable for the purpose, so that the electric units tested were tungsten and Nernst lamps. As the most modern representative of gas lighting the upright mantle cluster lamp or the so-called "gas arc" was chosen.

The tests were made by fitting up one bay of a floor, which was 15 ft. 6 in. by 55 ft., therefore having a floor area of 852 sq. ft. The illumination was measured on a test plane 30 in. from the floor, the measurements being taken at not less than 20 different test stations to insure as high a degree of accuracy as possible. The cost of gas was taken at its actual cost to the works, of 51 cents per 1000 cu. ft., and electricity at its actual cost of $1.22 per kilowatt hour.

An inspection of the accompanying table shows that the three-mantle inverted gas

FIG. I.—TUNGSTEN CLUSTER ILLUMINATION IN THE PAINT SHOP OF A LARGE AUTOMOBILE PLANT IN DETROIT.

arc was the most efficient lighting unit for gas and the four-light "shop cluster" the most efficient unit for electricity, and that under the conditions existing the latter gives 45 per cent. more illumination, with 53 per cent. less operating cost than the former, while the maintenance cost is 11 per cent. in favor of gas.

The tests were made by the chief electrical engineer of the works.

The following table gives the general results of the different units tested:

Kind of lamp.	No. of lamps.	Mean illumination in foot-candles.	Operating cost per hour—cent.	Maintenance cost per hour—cent.
Three-mantle inverted gas arc....	3	3.08	1.683	.625
Four-mantle upright gas arc......	2	3.13	1.84	....
Single glower Nernst lamp.......	6	2.12	.966	....
80-watt tungsten lamps, with aluminum coated reflectors.....	6	2.06	.586	....
"Shop clusters" of four 40-watt tungsten lamps................	..	5.637	.788	.7

Fixtures and Accessories

The Fixture Installation of Rector's, New York

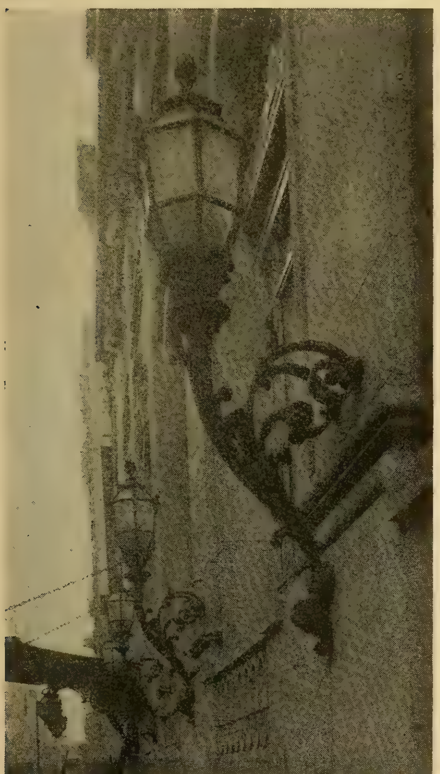


FIG. I.—EXTERIOR BRONZE BRACKETS.

To those who are more interested in high living than in the high cost of living, the name "Rector's" has long been a familiar word. A substantial evidence of the appreciation of the good cheer and choice viands served by this famous host is the magnificent new structure recently erected for his special use at the corner of Broadway and Forty-fourth street.

Much has been written and said about the necessity of lighting fixtures and illumination harmonizing with the surroundings. It may, therefore, be interesting to see how the architect and fixture designer have attempted to produce such harmony in a dining-room, where a $10 a plate dinner is a most ordinary affair and one at ten times this price nothing to brag about.

The architecture of the building throughout is essentially classic, showing

FIG. 2.—SCULPTURED STANDARDS AT ENTRANCE TO LOBBY.

FIG. 3.—ONE OF THE FOUR STANDARDS FOR LIGHTING THE LOBBY.

decided evidences of French influence. The exterior is of a light sandstone and the interior is in white, cream color and gold throughout.

The exterior lighting is by massive bronze brackets supporting lanterns, as shown in Fig. 1, and lanterns suspended under the marquise. There is also an outline of incandescents under the divisional moulding between the second and third stories.

The Broadway entrance leads directly to the main restaurant. Flanking the entrance are two heavy sculptured standards, one of which is shown in Fig. 2.

The lobby is entered directly from Forty-fourth street, and is lighted by chandeliers, brackets and standards. Fig. 3 shows one of four standards which are placed in niches on either side of the entrances to the main restaurant and the ladies' parlor. These are of verde bronze, with elaborate sculpture in *bas relief*.

Fig. 4 shows one of the brackets which are placed along the marble wainscoting. These are of dull gold finish and equipped with torch-like opalescent globes, as shown.

One of the three chandeliers is shown in Fig. 5. This is likewise finished in dull gold. As the vaulted ceiling is a very light cream color and the side walls of a light marble it would be next to impossible to produce anything but practically uniform illumination. The light-sources are all provided with either diffusing globes or frosted bulbs, and the illumination, though of high intensity, is

FIG. 4.—TORCH BRACKET USED IN THE LOBBY.

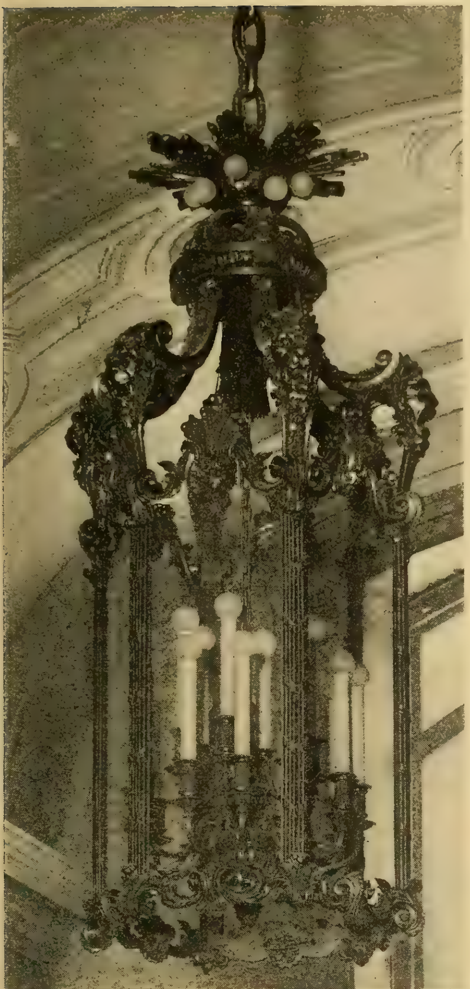


FIG. 5.—ONE OF THE THREE LANTERN CHANDELIERS IN THE LOBBY.

Rector's might be fairly described as a hotel built around a dining-room. The center of interest, architecturally and otherwise, is therefore the main restaurant, which occupies the ground floor on the Broadway side of the building. This is a magnificent room, two stories in height, expensively and artistically decorated and furnished, but in no sense gaudy or spectacular. As before stated, the decoration is of the French classic type in light cream color, with a fairly liberal use of gilding on the plastic decorations. The principal illumination is from three very massive crystal chandeliers, one of which is shown in Fig. 6. These are probably the largest fixtures of their type ever constructed or used in this country, each fixture weighing 2000 lbs. The metal work is sufficiently massive to correspond with the size of the fixture and the amount of glass supported, and is richly sculptured and finished in dull gold. Except the crown of lamps at

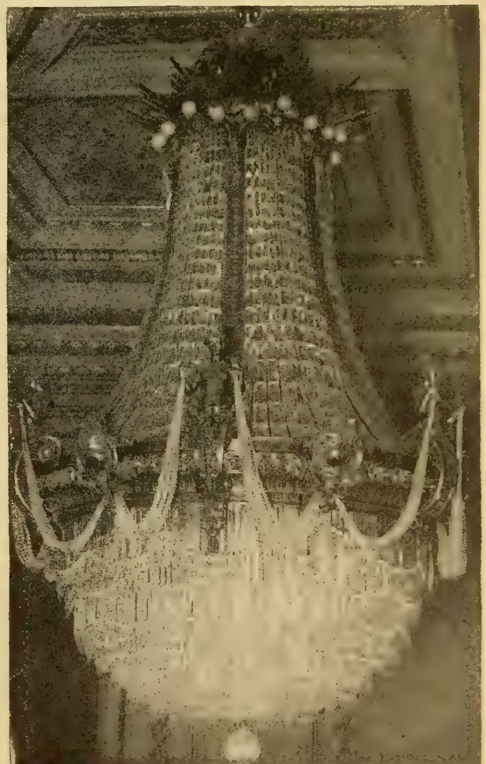


FIG. 6.—ONE OF THE THREE CRYSTAL CHANDELIERS USED IN THE MAIN DINING ROOM.

not in the least glaring, and produces a pleasing and cheerful effect. The one discrepancy in the installation, artistically, is the use of the round frosted lamps on the imitation candles in the chandeliers. This anachronism has been so frequently alluded to in these pages that it may seem trite to mention it again; but this most obvious discrepancy in the motive, which has been otherwise so well worked out, is difficult to understand. Fortunately it is a fault that can be instantly and completely mended at any time by the mere substitution of lamps with flame-shaped bulbs in place of the round frosted bulbs.

FIG. 7.—BRACKET USED IN THE DINING ROOM.

FIG. 8.—BRACKET IN GRILL ROOM.

the top, the light-sources are all placed within the cut glass ornaments, and consist of clear bulb tungsten lamps. It would be impossible to conceive of a more brilliantly beautiful source of illumination than this fixture. One may well believe the reported comment of the proprietor that "his $10,000 rugs might as well have been rag carpets, for nobody can see them for looking at the lighting fixtures. They are the center of attraction."

Besides these chandeliers there are equally handsome and appropriate brackets around the sides of the room, one of which is shown in Fig. 7.

Fig. 8 shows one of the brackets which form the chief illumination in the grill room. These are somewhat more severe in design, but in perfect keeping with the general motive. They are finished in bright Roman gold.

Fig. 9 shows a fixture used in the office. The design is clearly indicated in the engraving, and shows the same rich carving and harmony of proportion that prevails throughout. The finish is dull gold.

The banquet room is on the second floor

FIG. 9.—CEILING LIGHT IN OFFICE.

FIG. 10.—CHANDELIER. BANQUET ROOM ON SECOND FLOOR.

and is lighted by a single central chandelier, shown in Fig. 10, with dainty side brackets, with miniature lamps about the side walls.

Those who have been disposed to accept as a matter of course the alleged superiority of foreign designers and makers of fixtures will do well to give this installation a careful study with an open mind. The motives of all the designs are, of course, of French origin, necessitated by the general architecture and decorative schemes; but as works of applied art following a prescribed motive, they are most assuredly masterpieces in conception and unquestionably superior in workmanship to their "forebears."

Any one viewing this installation from the layman's standpoint cannot fail to be impressed with its perfect harmony, with the architectural and decorative setting in which it is placed; and as the former is of an exceptionally high order of merit, so must be the latter. Particularly noteworthy is the absence of that feeling of overstrained effort to attain elegance that has unfortunately been too often apparent in American practice. There is elegance, art, taste and refinement without ostentatious display of wealth; and this indeed is "a consummation devoutly to be wished," whether it is expressed in decoration, furniture, dress or lighting fixtures.

Architecture and Illuminating Engineering

Why the Architect and Illuminating Engineer Should Co-operate

The argument as to whether illumination is a science or an art, or, in other words, whether it belongs to engineering or architecture, seems to be no nearer a settlement than the old question of our school days as to what would happen if an irresistible force met an immovable body. The solution of the problem is perhaps best indicated in a reputed incident in connection with Stockton's much discussed story of "The Lady or the Tiger." Thinking to trap the author into answering the question himself, his hostess had prepared ices of different forms, among which were a lady and a tiger. Both of these were offered to Mr. Stockton with the question, "Which will you take?" Whereupon the famous writer immediately replied, "Both, if you please."

When the smoke of battle has cleared away it will be plainly seen that illumination is *both* a science and an art. In so far as it is a science it is properly classifiable among the various branches of engineering, which are, in a broad sense, only applied science; and in so far as it is an art it belongs not to pure art but to applied or decorative art. As architecture in its higher sense may be defined as the art of building, *i.e.*, the application of art to structures intended for the use and shelter of man, illumination forms one of the important problems with which the architect has to deal, both from the utilitarian and artistic standpoints. The simple admission of this very evident fact, viz., that illumination is both a science and an art, will forever remove the cause of this contention between the architect and the illuminating engineer. No sane architect would think of denying that building to-day is largely an engineering problem. There is scarcely a material that enters into construction that is not subjected to scientific tests of some kind, and its use limited or determined by the results of such tests.

Ideals Can Be Realized Only in Compliance with the Laws of Science.

In his discussion at the last meeting of the New York section of the Illuminating Engineering Society Mr. Bassett Jones, Jr., laid great stress upon the use of the imagination in laying out the lighting of buildings in which the artistic side of architecture is prominent. No one will dispute the fact that art of every kind is a result of creative imagination. The final result must be conceived distinctly and vividly in the mind of the artist before a single stroke of work toward its accomplishment can be performed. The architect sees the building, both within and without, pictured in his mind, and proceeds to embody his vision in solid materials; but before this vision can be realized there must be an immense amount of purely physical and mathematical labor performed. From the hod carrier, the quarry man, the wood cutter and the blacksmith to the sculptor, the mural painter and the artisan in metals, there is

a long train of work with materials that are gross and common and of labor requiring all degrees of skill and intelligence.

The architect, in order to realize his ideals, can no more despise or disregard the work of the engineer than the sculptor can disregard anatomy or the painter the laws of light and perspective. Art is the work of the human mind dealing with superhuman laws and materials. No architect by taking thought can add a cubit to his stature, nor change the crushing weight of granite, nor the tensile strength of steel, nor the optical law of inverse squares. His imagination, though it be an inspiration from on high, must be *constructive* to be of any avail; which is to say, he must conceive a concrete material structure, obeying the law of gravitation as well as the canons of art.

What the Illuminating Engineer Has Contended For.

This is all that the illuminating engineer has ever seriously contended for. No illuminating engineer worthy of the name has ever for a moment wished to dictate to the architect as to the artistic side of the problem of illumination, or attempted to argue that art is not one of the important problems. As a scientist, however, he has felt justified, and rightly so, in protesting against the subversion of the known principles of ocular hygiene to the dictates of art in the cases where art is manifestly an important element in the problem, and he has, furthermore, protested against uneconomical methods in the use of light where utility is the essential thing. Had there been no transgression in these two respects by the architectural profession at large there would have been no occasion for the establishment of illuminating engineering as a distinct science and profession. Illuminating engineering did not come into existence simply to furnish another occupation, but as the result of a demand for better methods in the use of light that was too general and too insistent to be set aside.

There has unquestionably been much misconception and unwarranted prejudice on both sides. In the absence of any restrictions upon the assumption of the title of illuminating engineer there is no denying the fact that it was appropriated by a very considerable number of would-be practitioners who had no possible claim to the distinction, either in experience, natural aptitude, general education or special training, and the prestige of the profession suffered greatly in consequence. On the other hand, there was a wholly unjustifiable amount of indifference and positive disdain of the new science on the part of the architectural profession. It was simply put aside with a wave of the hand as being wholly unworthy of attention, and while they resented as a presumption the claims of specialists in this particular line they showed absolute inconsistency in turning over the illumination of buildings to junior draftsmen, electricians or fixture manufacturers regardless of their ability or inability to handle the subject with skill and intelligence.

The plain truth of the matter is that the architectural profession either quietly ignored or openly opposed illuminating engineering as such at the beginning of the movement for its establishment. This antagonistic attitude naturally aroused resentment on the part of those honestly seeking to improve the practice of lighting through this means, and the inevitable followed—criminations and recriminations, charges and counter charges. In the vernacular of the day there was a "scrap" on between architects and illuminating engineers with some right and some wrong on each side.

A Better Understanding Now Prevails Between the Professions.

With the steady progress in the development of illuminating engineering better counsels have prevailed; the architect has come to recognize that the problem of lighting is not only an exceedingly important one, but one which is growing in importance and complexity at a rapid rate, and which requires a very large amount of special study in order to master its details and keep up with progress. He has also realized that a given effect, even though of the highest order of art, is not exempt from the laws of science or beyond the practice of economy.

Still further has the architect realized

that there are a very large number of problems; in fact, the great majority in numbers in which utility is so far in the ascendency in importance as to make art a wholly adventitious property; and in these cases the advice of a practical engineer, who is devoting his entire time to the study of the conditions involved and the best method of meeting them, can be of as great value comparatively as that of the construction engineer, the electrical engineer or any other competent specialist.

On the other hand, the embryonic illuminating engineer has learned to be more cautious in arrogating to himself entire authority in questions of illumination, at least where art is an important consideration. The title of illuminating engineer is now assumed with a great deal of modesty and caution. The day when an ordinary salesman learned the law of inverse squares at night and sallied forth as a full-fledged illuminating engineer in the morning is past. The profession has reached the first step in wisdom; it has learned how little it knows of the subject at the best and how infinitely much more remains to be known than is now known to all collectively.

The Organization of the First Illumination Study Club.

An event which recently transpired in St. Paul, Minn., is of unusual significance as bearing upon the question at issue. This was the formation of an Illumination Club, of which the following particulars are issued by its secretary:

At a meeting held in the offices of Reed & Stem, architects, St. Paul, Minn., on Thursday evening, January 5, 1911, an organization was formed which will be known as the Illumination Club of St. Paul.

The object of the organization is the advancement of illuminating engineering and the study of all subjects connected with illumination in any form. In addition to the presentation and discussion of papers it is planned that the club shall be a medium of exchange for general illuminating engineering information and data. The secretary will endeavor to collect from manufacturers and others all available data on various light-sources and accessories, and will keep this information for reference by the members. The usefulness of the organization will be extended in other directions if the membership increases according to present indications.

A programme has been prepared for six meetings, from January to June of this year, and a tentative programme has been outlined for the season of 1911-12. Until further notice these meetings will be held on the second Monday of each month in the offices of Reed & Stem, 601 Endicott Building. The subject for the next meeting, which will be held on Monday, February 13, is "Street Lighting," and the paper of the evening will be given by Mr. Earle B. Jackson, consulting engineer, St. Paul.

At last Thursday's meeting Mr. Arthur L. Abbot presented a paper on "Some Notes and Data on Illuminating Engineering," which was highly appreciated.

Officers were elected as follows: Chairman, Mr. Arthur L. Abbot; secretary, Mr. Clovis M. Converse. The secretary's address is 303 North Snelling avenue, St. Paul, Minn.

The particular significance of this event is the fact that this club evidently originated among the local architects and is dominated by their influence. It would be naturally supposed that a sufficient number of people to form a club for the study of illuminating engineering would have constituted themselves a section of the Illuminating Engineering Society. The fact that they preferred to remain independent must be construed as due to a desire on the part of the dominating influence—the architects to maintain their autonomy and to study the subject from their own viewpoint. This should not be looked upon as a schism in the profession, but rather as the natural result of the three-fold nature of the subject, viz., the technical or engineering, the artistic and the physiological and hygienic. The first of these divisions is covered by the Illuminating Engineering Society; the second is the field in which the Illumination Club, representing the architects, evidently proposes to cover; while the latter, which is by far the broadest of all in its importance to the user of light, is the field of the proposed Association for the Conservation of Vision, which was noted in our last issue.

There is not the slightest occasion of fear for dissension and destructive competition between these three branches of the subject. On the contrary, the work done by the different interests, properly co-operating, will be more than three times as great as could be accomplished by attempting to spread out a single organization over the entire field.

The movement of the architects of St.

Paul will undoubtedly be followed in other large cities; it is to be earnestly hoped that it will. The serious and conscientious study of lighting from any and all viewpoints is something of which there is no danger of getting too much. Knowledge is a good thing, and that which adds to its sum total is to be cherished under whatever form it appears. Let the good work go on, and let everyone who either contributes to its success or benefits by its result be ever ready to give a word of cheer and a helping hand.

Water Power as a Source of Light

Agitation for the conservation of the natural resources of our country met an instant popular response. After squandering the patrimony of well-nigh unbounded proportions which Nature had given us with an absolutely unrestrained prodigality for the past two centuries and permitting what, by all the laws of natural right, belonged to the people in common to come largely into the possession of private parties, we have suddenly awakened to the fact that there is a limit even to the vast resources of our country. To be sure, the movement savors much of locking the barn after the horse is stolen, but even that were better than not to lock it at all. In our zeal to make sure that the barn *is* locked we have braced the door with so many props and barricades that we now find it next to impossible to get in to use our own property.

That such natural resources as water powers, mines of coal and the useful metals should belong in perpetuity to the people to be used to the greatest good of the greatest number is a proposition that few would dispute. The natural resources which are necessary to sustain life under modern conditions of civilization must be procurable by a reasonable expenditure of labor and diligence by every member of society or society becomes a despotism which is self-destructive. Modern civilization could not exist without the use of the common, or " base " metals, and a means of producing heat and light. The sources of these prime necessities must, therefore, be in some manner controlled by the State.

But control does not mean hedging them about with so many tangible and intangible difficulties as to prevent their free and full use by the people. The result is the same when the State prevents the use of a water power by making its use unreasonably difficult or burdensome as if it were done by a private individual or corporation. This seems to be the most imminent danger to the people at the present time. Our mines have long since passed into private control, and it is not likely that this will ever be changed, except in some of our remote possessions. Our water powers have to a considerable extent followed the same course, but there are still a considerable number that remained unmonopolized at the time the Government awakened to the necessity and propriety of exercising a measure of control.

Government Control Should Not Obstruct Public Use.

But it appears that in exercising this control the restrictions and difficulties thrown in the way of the practical utilization of these water powers are of such a nature as to practically put them entirely out of use. This is a far greater misfortune than to have them monopolized by private interests, for in the latter case the public would reap a certain proportion of the benefit, whereas under present conditions it obtains none at all.

The National Electric Light Association, which represents an industry of $2,000,000,000 invested capital, is promoting a movement to have the matter investigated by a joint committee of Congress. Assuming that such a commission would remove the present obstacles and result in the development of the different water powers with the greatest possible speed, the movement is one that cannot be too heartily approved. Let us not be so frightened at the word " monopoly " that we cannot appreciate that a monopoly by government is no better than by individuals, unless its power is exercised in the proper manner for the benefit of the people.

If the present government monopoly is so burdensome as to prevent the use of water powers—which appears to be the case—then by all means let it be so modi-

fied as to accomplish the purpose for which it is intended. That this may be done in an impartial and wise manner the proposed Congressional committee should be appointed at the earliest possible date. The fact should be appreciated and remembered, that, in these days the practical use of the scientific principle of the conservation of energy, a water power is the exact equivalent of a coal mine, with the single difference that it lasts forever, while a coal mine sooner or later becomes exhausted. To prevent the development of a coal mine would be transferring the benefits of its use from the present to future generations, but to leave a water power undeveloped is to absolutely waste its value: "the mill will never grind with the water that has passed." Such a waste is, therefore, a double prodigality; not only do we lose the power of the water but must draw upon the supply of coal for the deficiency.

The People Should Have the Full Benefit of Niagara's Power.

While on this subject we cannot forbear referring to the largest of all water powers in this country, Niagara Falls, and to the childish and absurd public sentiment which has attempted with some success to allow to go to waste perpetually for the sake of the spectacular effect which the fall produces. It would really be more sensible and economical to give all the honeymooners who wish to regale themselves with this cheering sight a free trip to Europe than to waste this enormous source of energy for their particular delectation. It will be a great day for the American people when the precipice at the bed of the St. Lawrence River at Niagara is as dry as a lawyer's brief, and every drop of water from the great lakes is turned into the sluiceways of electric generating stations. We acknowledge no superior in appreciation of the beauties of natural scenery, but we have a still higher regard for the comfort and physical well-being of the millions who can never witness this spectacle nor perhaps half appreciate it if they did. Who would not prefer to enjoy all the comforts which a cheap supply of electric current would realize in the home for 365 days out of the year than to gaze for a few hours on this spectacular piece of natural scenery?

Efficiency of Labor

Modern civilization, as distinguished from medieval or ancient civilization, is characterized by the extent to which science is utilized in the everyday affairs of life. Natural science is a wholly modern creation. It has been well defined as "a mode of thought"; but this definition needs further analysis. The particular mode of thought which constitutes natural science consists in first observing how Nature does things, and then using the same means to accomplish the results artificially, *i.e.*, by human means. The scientist is first, of all, an analytical observer, and, secondly, a synthesist.

This mode of thought among other important results has been responsible for the invention of the enormous variety of labor-saving machinery, which exerts a dominating influence upon human labor at the present time. So far as physical labor is concerned, man himself is nothing but a machine, and by studying carefully just what motions are made and in what particular order they are performed in any particular labor and reproducing these by mechanical contrivances, a large part of all the tasks which were formerly accomplished by the human machine are now performed with far greater speed and accuracy by the imitative devices which the scientific mode of thought has made possible.

Machines are labor saving in two senses: they save human labor absolutely by performing that which previously required human effort, and relatively by accomplishing a given result with a less expenditure of time. It is sometimes said of a complicated machine that it "can do everything but think"; herein is the impassable barrier to the scientific inventor. The machine never will think, and must be given more or less attention by the only thinking machine—a man.

It is a rather curious fact that with all the analytical study that has been given to the motions required in the numerous manufacturing processes in order to devise mechanical means for their performance until very recently almost no attention has been given to a similar study of the mo-

tions required for the operation of such machinery. Such study, however, has now become another one of the numerous engineering specialties, and the "efficiency engineer" is a recognized expert.

There is another essential difference between the physical and the human machine: the latter not only thinks but *sees;* and both of these actions are absolutely essential to its operation. Of these two necessities, seeing is the more important. There are still many operations in human labor that become semi-automatic and require exceedingly little thought; but the number that can be performed without a fairly careful effort of the eyes is exceedingly small.

Much has been written and said since illuminating engineering became a profession on the extent to which inadequate and improper illumination prevails in the industries. There is no doubt as to the truth of the matter, but the cause for surprise on this point is much lessened when one considers the almost total lack of scientific methods in the regulation of the individual and collective work of operatives. It is doubtful if the efficiency engineers themselves have any adequate conception of the importance of illumination as a factor in the efficiency of labor, but they should realize that no matter how carefully they may adjust the motions necessary for the operation of a machine or factory, they will be wholly impossible in total darkness, and only partially possible with insufficient or improper lighting.

The efficiency engineer and the illuminating engineer should lose no time in getting together for their mutual advantage, and to the benefit of their clients. Here, indeed, is a field in which the illuminating engineer will not be limited by questions of "historic feeling" or "artistic motive." We have not yet reached the point where machinery is designed in accordance with Louis XIV. or Colonial motives; whether a machine is turning out blue jeans or brocade, the manufacturer is intent on getting it out at the least cost per yard, and to this end is anxious to eliminate every lost motion and every second of wasted time on the part of the laborer.

A writer in the *Review of Reviews,* speaking of the conservation of labor, says:

"The hearings at Washington made the opening of a great campaign, the first campaign of real 'conservation' ever launched in this country. We have cried aloud at the waste of our natural resources, failing to see that of time and labor, ever the most strictly limited of our treasures, we have learned to conserve but little. We have rebelled at the high cost of living, but have had no sounder resources than to blame therefor everything in sight and out of sight. We have raged at monopoly, but have neither penetrated the secret of the efficiency of monopoly nor the means of controlling it."

No more obvious or impressive proof of this statement can be found than the total lack of scientific attention to illumination which has prevailed until within the most recent time and still prevails in the great majority of cases. Illuminating engineering is, therefore, one of the most valuable of all conservators, for its chief application is in conserving time and human labor.

The Physiological Aspect of Illumination

The last meeting of the New York Section of the Illuminating Engineering Society was given over to a subject which has received too scant attention in the past, viz., the causes and effects of eye-strain. The discussion of the papers presented brought out forcefully the very limited extent of positive knowledge on this important subject. Just what happens in the process of vision is still largely a matter of unproved theories, and much work remains to be done by the scientific investigator before the matter is definitely cleared up.

It is by no means necessary, however, that we wait for a complete and positive solution of the physical, physiological and psychological problems involved in order to come to valuable conclusions as to what qualities and uses of artificial light are injurious to the visual organs. It is recorded that the blind man whose sight was miraculously restored was not particularly concerned with the causes of the restoration, but was appreciative of the fact, "Whereas I was once blind, I now see."

While the scientific explanation of phenomena is always of interest and of more

or less practical value, very great use can be made of facts whose ultimate explanation is unknown. The action of light upon the photographic plate is not yet a matter of positive knowledge, and yet the fact is utilized to an enormous extent. What we most want to know is what uses of artificial light are most agreeable to the visual organs and what are deleterious or injurious. This is a subject upon which information of a highly important character can be obtained by scientific methods of investigation without reference to the reasons why. Whether or not eye fatigue or strain is due to exhaustion or decomposition of visual purple is of quite secondary importance to determining what kind or quality of light produces eye fatigue or strain.

The rather astonishing fact was brought out in the papers that certain conditions which are commonly classed under the general head of "glare" and which produce eye fatigue or discomfort, do not, at least for short intervals, interfere with visual acuity; in fact, in some instances the acuity of vision is actually increased.

Before these important questions can be solved the psychologists and the illuminating engineer must take a hand with the ophthalmologist. The new Association for the Conservation of Vision has an immense possibility for practical results in bringing these three scientists together, and much is to be expected from the results of such co-operation. The greatest fault of all investigations pertaining to light and vision at the present time is their lack of co-ordination. The organization of this new asssociation, whose chief purpose will be to co-ordinate and direct the various lines of investigation of this subject, is most opportune, and the remarkable amount of public attention which the matter has already received is a convincing and cheering evidence of public interest in the matter.

Notes and Comments

DEMAND FOR BETTER LIGHTING STILL HEARD IN PHILADELPHIA

"THE BEST LIGHTED CITY IN THE WORLD" TO BE USED AS AN ADVERTISING SLOGAN.

The appetite for good illumination is one that grows with feeding. Philadelphians seem to have a limitless desire to feast upon this desirable public utility. An issue of a daily paper which does not contain a demand on the part of some section or individual for "more light," or the "same light that they have on Market street," is considered a "back number." Mr. James McLaughlin, chief of the electrical bureau, keeps public spirit up to the top-notch voltage. In a recent interview published generally in the daily press he says:

"Philadelphia is the best lighted city in America, and it is a great mistake to conceal from the public outside of Philadelphia the very many things in which the city excels. I expect to see the day when the slums will be wiped out by multiplied electric lights. Believe me, gentlemen, electric lamps serve as police and as scavengers, and they save all they cost by preventing both crime and disease. The economic value of an arc light in the final analysis cannot be computed, but every police official knows that such a lamp is the best possible watchman, and we can't have too many of them."

But electricity is not to have the whole field to itself, it appears. The gas people have taken a hand in the game, and have made a demonstration of the possibilities of modern gas lighting for street illumination on an outlying portion of Market street. The result is thus given in the *Bulletin:*

"Merchants whose places of business are along Market street, between Fifty-first and Fifty-third streets, last night engaged in a 'celebration of illumination,' to mark the installation of new gas lamps before the stores.

"These lamps, which make the thoroughfare at night almost as light as in the day, were turned on for the first time last evening. The poles, each of which bears an incandescent lamp of high power, are shaped like a shepherd's crook."

The *Evening Times* has the following excellent editorial on the general subject of public lighting:

"With the exercise of proper economy, an adequate lighting system is a good investment.

"So long as light is not absolutely wasted, there cannot be too much of it.

"All of Philadelphia should be well lighted—this should be the best lighted city in the country.

"And its various districts, like West Philadelphia, South Philadelphia, the northwest and the northeast, ought to have their commercial arteries illuminated to make them almost as light as day.

"This is protection.

"It encourages business and it is an evidence of progress."

RATING OF ARC LAMPS AGAIN GIVES TROUBLE

WASHINGTON'S COMMISSIONER DISCOVERS DISCREPANCY BETWEEN INCLOSED AND OPEN ARC LAMPS.

The mischief of the "nominal rating" of arc lamps which was allowed to pass current in the time of the old open arc still occasionally turns up. The latest discovery that the inclosed arc, which has entirely superseded the open arc for street lighting, does not give as much light, lamp for lamp, as its predecessor, has been made by the Engineer Commissioner of the District of Columbia. It appears that the original contract for street lighting specified arc lamps of 1000 candle-power, which undoubtedly referred to the open arc, and that for nearly ten years the lamps used have given only 700 candle-power. The matter is under investigation, according to the *Times:*

"The investigation thus far has revealed the fact that the change from the 1000 candle-power lamps to the 700 candle-power lamps was made during the fiscal year 1901, by order of the District Commissioners. The order bears the date of November 5, 1901, and is as follows:

"Ordered:

"That the United States Electric Lighting Company is hereby authorized to change its series of open arc lamps to those of the inclosed type, in accordance with the recommendation of the electrical engineer, under date of October 21, 1901."

This is an unfortunate occurrence, since it reflects, in the minds of those not familiar with the technical differences in the two kinds of lamps and in the still more important difference between light in candle-power and illumination on the street, upon the most excellent work of the District Engineer, Mr. Walter C. Allen. If an open arc with a rating of 1000 candle-power has been replaced with an inclosed arc having a rating of 700 candle-power the citizens are getting more than an equivalent in effective illumination, and that is the only thing that they are interested in. The one fortunate thing about the situation is that Mr. Allen's immediate superiors are public men of intelligence and freedom from commercial or political bias, and there should be little difficulty in making the situation clear.

LIGHT A SECONDARY MATTER IN DECORATIVE STREET LIGHTING

AT LEAST THIS IS WHAT THE MERCHANTS OF SYRACUSE ARE TOLD.

Syracuse is one of the comparatively few Eastern cities that has installed a system of the new decorative tungsten lighting with cluster lamps and ornamental posts. For the first time since the movement for this sort of lighting began a decided note of complaint is heard. The nature of this complaint is thus given by the *Herald:*

"Considerable comment, expressing dissatisfaction or disappointment, has been heard concerning the new ornamental street lamps, in that the light provided by them is too much on the fire-fly order.

"Some of the merchants when seen by a *Herald* man, expressed their feelings facetiously, but pointedly, nevertheless. 'From the talk I got,' said one of them, 'I expected that beautified Syracuse would be lanes of light which would turn every street into a "Great White Way," bidding for another metropolitan feature for Syracuse; but when I looked down street last night, I thought it was a representation of the Milky Way, very much watered at that.'

"Arthur Dudley, commercial agent for the lighting company, who has charge of the street lighting plan, when questioned this morning said, when it was remarked that there was considerable dissatisfaction with the lamps' illuminative power: 'This system is not a street lighting system, but ornamental in light effect. It originated in the West, and we are using the same power of lamp as they use out there. We could use large lamps, but the effect would not be as good. On each post the five lamps amount to 160 candle-power. The idea in this system is not to light the street—the street corner lights do that; it is to place in the globe a lamp which will just fill the globe and diffuse the light so that when you look down the street you get a pleasant boulevard effect through the rows of light.'"

Assuming that the *Herald* is right in its statements, the lighting company is "in

wrong" this time; 40-watt tungsten lamps, equivalent to 32 candle-power, are certainly much below the average, especially in cities of this size, 60-watt being the lowest used, and the majority of installations using 100 watts, equivalent to 80 candle-power. There may be reasons for this that do not appear on the surface, but otherwise it is certainly a short-sighted policy.

ST. PAUL MAY TURN OUT THE LIGHTS ON ITS "GREAT WHITE WAY"

A SPASM OF MUNICIPAL ECONOMY HITS THE LIGHTING APPROPRIATION.

To light up or not to light up is the question in St. Paul. The city has an admirable decorative lighting system, but the budget for lighting during the coming year has been cut so as to endanger the continuance of its operation, much to the disgust and protest of its leading merchants. The following from the *News* is one of many opinions of similar character:

"J. George Smith, president Associated Merchants: It will be to the shame of St. Paul if the 'way of light' is extinguished. The city should get the right price on its lighting rates, and there would be no need of pruning on the street lamps. A man who would not spend some money on his best girl would be a 'dead one.' The street lights bear the same relation to a city, metaphorically speaking, and the city that does not spend on the 'light of its life' is a 'dead one.' St. Paul not being an Utopia nor this being the age of the millennium, we cannot run a city without taxes. Money spent for street lights is well spent."

IN DETROIT LIFE WILL BE WORTH LIVING—

IF IT PUTS IN THE NEW DECORATIVE STREET LIGHTING.

Detroit is one of the few cities enjoying a successful municipal lighting plant. But municipal plants do not have quite the same interest in booming public lighting that a private corporation has, to which may be possibly attributed the fact that Detroit is only now beginning to agitate the matter of decorative street lighting. The President of its Board of Commerce has been looking up the subject, especially in Minneapolis, and some of his comments, as reported in the *Journal,* are well worth repeating:

"Minneapolis is the most beautifully lighted city in the world," says President Abner E. Larned of the Board of Commerce, who has looked upon the Flour City's street lighting system, of ornamentation and utility, and is desirous that Detroit, with better natural advantages for display, should have a similar system.

"Minneapolis has found that ornamental and brilliant street lighting pays. The people throng to the bright streets by night as they seek the sunlight by day, and the merchants are gainers by the display and publicity given their goods. The effect is as continuously pleasant to the permanent as it is strikingly so to the new arrival."

VARIOUS NOTES OF INTEREST CLIPPED FROM THE DAILY PRESS

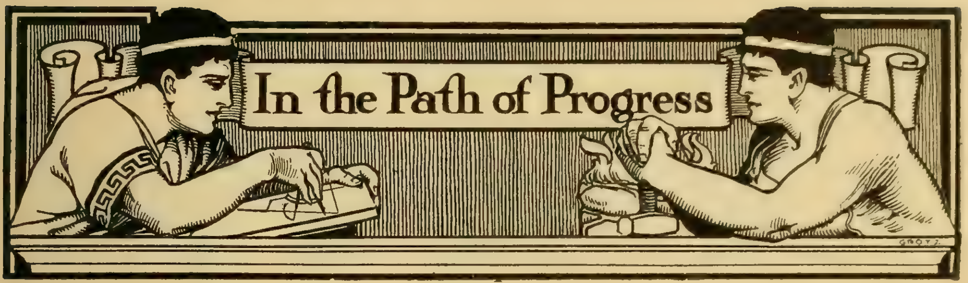
Making brilliant the whole scene overhead blazed the thousand upon thousand of incandescent lights which had not showed themselves for months. The spirit of Christmas found itself into the inner sanctum of the Asheville Electric Company, and as darkness came on to the great delight of the joyous throngs on the streets the electric current was sent over the wires crossing and criss-crossing the streets with a brilliancy most fitting to the season.—*Asheville, N. C., Citizen.*

The Colorado Electric Club met yesterday in annual session, at the Albany Hotel, and elected a board of directors for the ensuing year.

C. F. Oehlmann, retiring secretary, was the recipient of a fine leather Morris chair, the gift of the club, "for faithful services rendered during the year," according to the inscription on a silver plate on the chair. The presentation address was made by John F. Greenawalt of the Colorado Telephone Company.—*Denver Republican.*

Plans for a lighting system for the business district of Omaha and for connecting the city's two boulevards have been worked out by City Engineer Craig in anticipation of a movement to be started following the revision of the city charter to make street illumination possible.—*Omaha, Neb., News.*

Shall the village of Brattleboro install ornamental lamp posts with wires underground through Main street, from the Brattleboro House to the Library, is a question which is being considered by the board of bailiffs. The resolution calls for 100-watt 80 candle-power incandescent tungsten lamps sufficient in number to light the streets satisfactorily. This means doing away with the arcs, which have proved unsatisfactory and expensive.—*Springfield, Mass., Republican.*



New Publications

The Opalux Company, New York, has issued an eight-page bulletin illustrating a new line of Opalux reflectors and giving photometric curves of each of its different types and sizes, with dimensions and prices.

The Western Electric Company, New York and Chicago, in Bulletin No. 9645, gives a complete description with engineering data of the Moore white light "window" for color matching, which was described in our last issue, this company having recently taken the sales agency.

The Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, has issued three new bulletins as follows:

Bulletin 5-C: Tantalum Multiple Lamps.

Bulletin 8-B: Mazda Miniature and Low Voltage Lamps.

Bulletin 15: Electric Sign Lighting.

These bulletins contain the usual amount of accurate and valuable engineering data on the particular subjects treated.

Personal

Mr. H. Thurston Owens, consulting engineer, New York, has accepted a position as associate editor of the *American Gas Light Journal,* the oldest publication treating of the lighting industry in this country.

Mr. Owens was for some time connected with the Department of Water, Gas and Electricity of New York City, in which capacity he became especially familiar with the statistics of public lighting. He has contributed a number of articles to The Illuminating Engineer, and has become well known to illuminating engineering circles through his papers and discussions at the meetings of the Illuminating Engineering and other societies. Mr. Owens is a close student and keen observer, and a young man possessed of positive opinions, to which he has the happy faculty of giving forceful expression. We congratulate both Mr. Owens and the *Gas Light Journal* upon what we consider a mutually propitious event.

Mr. Charles E. Ummach, who recently severed his long connection with R. Williamson & Co., Chicago, to assume control of the W. S. Edwards Mfg. Company, fixture manufacturers, has disposed of his interest in the latter company to return to his former allegiance in the capacity of secretary and treasurer of the company. Mr. Ummach probably has as strong a grasp upon the general fixture business through the Middle and Far West as any individual in the country, and his return to the Williamson Company with extended powers and responsibilities will undoubtedly redound to both his own personal advantage and the success of this well-known concern.

Mr. Harold Kirschberg, who has been the illuminating engineer, *de facto,* of the Pennsylvania Railroad for the past five years, has resigned his position with that company, and on February 1 will take up the work of organizing a general engineering department for the Heany Lamp Company, the Tipless Lamp Company and the Novelty Incandescent Lamp Company jointly. Mr. Kirschberg has had an exceedingly varied and wide experience in connection with his railroad work, and is a thoroughly trained electrical engineer. With his wide knowledge of the subject, and his natural ingenuity and aptitude for research and investigation, the organization of this new engineering department

See the Want Ad Pages for LITTLE STORIES OF BIG OPPORTUNITIES.

THE ATLANTA GEORGIAN
AND NEWS

See the Want Ad Pages for LITTLE STORIES OF BIG OPRORTUNITIES.

VOL. IX. NO. 115 ATLANTA, GA., THURSDAY, DECEMBER 15, 1910. PRICE. In Atlanta TWO CENTS On Train FIVE CENTS

COME TO THE OPENING OF THE GREAT WHITE WAY TONIGHT

The Merchants Will Keep Open House---There Will Be a Monster Parade and Fun for Everybody.

THE BRILLIANT LIGHTS of Atlanta's Great "White Way" will shine tonight. When the parade of the Ad Men's Club starts at eight o'clock Thursday night at the Aragon Hotel and becomes the signal for turning on the great white lights, block by block, it will mark an epoch in the history of advancement of Atlanta, the Half-Million City.

Too much praise cannot be given to the men who have made this project possible. To the city council; to the Georgia Railway and Electric Company; to the property owners and the merchants from the Aragon Hotel to the Terminal, and to the Press, Atlanta is indeed indebted, for these have spent their time and money and have made successful the Great White Way. In so doing they have exemplified that same public spirit which has made Atlanta the hustling, thriving metropolis of the South, and that same spirit will make it the "Half-Million City."

Thursday night, Peachtree, Whitehall and Mitchell streets will be fairly alive with happy people, full of the carnival and Christmas spirit and showing by their presence and enthusiasm Atlanta's appreciation of the benefits to be derived from this turning of night into day on the principal streets.

The merchants will all keep open house, offering bargains to the Christmas buyers, and Atlanta will equal New York on this occasion. The Georgian is proud in having a helping hand in this movement, and invites all friends and readers to come out and help make the occasion a memorable one.

Let the Lights of the Great White Way shine on to Atlanta's further prosperity.

THE "GREAT WHITE WAY" IN ADVERTISING. REPRODUCTION OF A FULL-PAGE ADVERTISEMENT OF THE OPENING OF THE "GREAT WHITE WAY" IN ATLANTA, GA.

under his direction is an event of importance in the illuminating engineering field. The companies are to be congratulated upon both their progressive spirit shown in combining their engineering work and in the selection of Mr. Kirschberg as chief engineer.

The Massachusetts Institute of Technology, Boston, reports excellent progress in its graduate electrical engineering

work, the number of students taking this work for Master's and Doctor's degrees being greater than last year. The subject of illumination and photometry has been added to the subjects taught in the electrical engineering department. This is treated from the standpoint of what is generally called illuminating engineering, and is made an optional study. The instruction is by lectures, recitations and laboratory work, under the direction of Professor Wickenden, who is the author of a well-known book on "Illumination and Photometry."

The Great White Way in Advertising

On the preceding page is shown a reproduction of a full-page advertisement which was inserted in the Atlanta newspapers at the opening of its "Great White Way." In addition to this special announcement, a perusal of the general advertising in the same issue of the paper showed that more than half the merchants made some reference to the White Way in their advertising, and many of them had apparently increased their space in order to attract the attention of the expected crowds.

A White Way works both ways; it is itself an advertisement, and it is a thing worth advertising. The value to a city of decorative lighting has been stated by many men in many ways, but in no case has it been demonstrated more effectively than by this extensive newspaper advertising. While merchants are no less patriotic than other citizens, they are much keener judges of advertising, for the reason that it is an important part of their business; and the fact that they have so universally indorsed decorative lighting as a good investment by investing in it themselves places its value beyond dispute.

N. E. L. A. Growth

With the new year the National Electric Light Association has taken another leap forward in membership, and on January 21 crossed the 6500 line. This is a gross gain of over 1500 since the St. Louis convention and a net gain of about 1250. The Canadian Electrical Association voted last week to affiliate with this body, and this will also bring a large accession; while new company sections are being formed in Pittsburg, Allegheny City, Scranton, Connellsville, Pa., and other cities. Mr. H. H. Scott, the chairman of the Membership Committee, estimates that 7000 members will be enrolled by the end of the month and that the number may easily be 8000 by the next annual convention in June. The membership fifteen months ago was slightly over 3000. A large number of smaller central station companies are included in the new membership. The association has been invited to hold our 1912 convention in Portland, Ore., by the Governor of the State, Mayor of the city and local companies. The Executive Committee favors taking such a visit to the Pacific slope under the circumstances, and has appointed a special committee, comprised of John F. Gilchrist, chairman; Charles L. Edgar and W. H. Blood, Jr., to look into this matter and report upon it.

Announcement

The February meeting of the New York Section, Illuminating Engineering Society, will be held Thursday evening, February 9, in the Dungeon of the Castle Cave, 271 Seventh avenue, between Twenty-fourth and Twenty-fifth streets, at 8:15 o'clock. The meeting will be preceded by a beefsteak dinner at 6:30 p.m. prompt, for which this Bohemian café is famous. Price $2.50 per plate.

The topic of the meeting will be "Light and Architecture." Henry Hornbostel, Esq., of the architectural firm of Palmer & Hornbostel, will lead the discussion.

Any person interested in the use of light, natural or artificial, is cordially invited to attend the meeting and the *most informal* dinner which precedes it. Owing to the character of the dinner, it is necessary that those wishing reservations to acquaint the secretary of their desires immediately.

Albert Jackson Marshall, Secretary.
36 West Thirty-ninth Street.
Murray Hill—3372.

Proceedings of Technical Societies

The Illuminating Engineering Society

The December meeting of the New England section was held in Boston on the evening of the twelfth. An illustrated talk on the "Evolution of the Arc Lamp" was given by Mr. C. A. B. Halvorsen. A history of the lamp was traced from the first arc produced by Davey in 1810 to the latest forms of arcs now in use.

Additional interest was added by the projection of different types of arcs themselves directly under the screen.

The December meeting of the Chicago section was held on the fifteenth. After a luncheon, a paper was presented on the

COMPARATIVE COSTS OF PRODUCING LIGHT WITH DIFFERENT ILLUMINANTS, by Messrs. J. M. Bryant and H. G. Hake.

This paper is an unusually comprehensive treatment of the subject, taking into consideration the operating costs and renewals of forty-one different types of lamps, thirty-one electric, and the others including gas, acetylene, kerosene, gasolene and alcohol lamps.

The annual meeting of the Illuminating Engineering Society was held in the rooms of the Machinery Club, 30 Church street, New York City, on the evening of January 13. About forty members were present. President E. P. Hyde presided at the banquet with his usual felicity, and short speeches were made by Mr. W. W. Freeman, president of the National Electric Light Association, and by Dr. C. H. Sharp and Mr. L. B. Marks, past presidents of the Society. Greatly to the regret of all present, Dr. Kennelly, who was declared elected president for the coming year, was unable to be present.

A report of the general progress of the Society during the past year was read by Secretary Millar. An analysis of the membership is particularly interesting. The membership has increased from 1045 to 1530 during the past year. Of the present membership 60 per cent. represents the electrical industry, 20 per cent. the gas industry, the remaining 20 per cent. representing various interests, among which only 1 per cent. was represented by the architectural profession.

The New York section held its January meeting on the evening of the twelfth, at which three papers were presented, as follows:

ARTIFICIAL ILLUMINATION AS A FACTOR IN THE PRODUCTION OF OCULAR DISCOMFORT, by Nelson M. Black, M. D.

The author gives the symptoms of ocular discomfort, which he carefully distinguishes from the more serious and pathological conditions. After describing the various forms of ocular discomfort, the writer makes the following interesting statement:

"In all honesty it must be confessed that ophthalmologists are woefully ignorant as to the exact cause of this ocular distress, one reason being that the changes which take place in the visual apparatus when subjected to bright light are not well understood and still less is known of the changes which take place when the eye is subjected to the spectra of different illuminating sources. As a result no adequate means of relief have been suggested."

A short description of the visual apparatus is then given, followed by a short discussion of the effect of bright light (glare). The subject of ultra-violet light is taken up, and from the latest observations the following conclusions are drawn:

"Thus it will be seen that with the cornea absorbing rays of wave lengths less than 295 microns and the lens those less than 400 microns, practically no ultra-violet rays reach the retina so that their ill effects upon the eye, if any, would probably be entirely superficial and to produce symptoms similar to mild electric ophthalmia—that is, pain, photophobia, lacrymation, hyperæmia, swelling of the conjunctiva and mucoid discharge, which are not the symptoms under discussion."

The author then goes on at some length with an exposition of his hypothesis that ocular discomfort is physiologically due to the exhaustion of the visual purple more rapidly than it can be reproduced. His concluding paragraph is as follows:

"Ocular comfort in close use of the eyes under artificial illumination may, to a certain extent, be secured by using protective media, such lenses having the power of absorbing certain radiations or of diminishing the intensity of the rays; in some occupations this is absolutely essential. In all probability, however, the most important factor is to determine exactly what physiologic effect artificial light has upon the eyes, and let such findings be a guide as to its proper use. The problem is no easy one, but its solution is very essential to the ocular comfort of coming generations, which should be sufficient stimulus for immediate and earnest investigation by all departments of science involved."

Physiological Points Bearing on Glare, by Percy W. Cobb.

The author, after referring to the great breadth of the subject, deduces a definition of glare for the purpose of his paper, as follows: "Glare is discomfort, or depression of the visual functions, associated with strong light sensation." The conditions for the production of one, or both, of these effects by general illumination of high intensity and of special brightness in parts of the visual field are then discussed. After stating the necessity for the use of diffusing media in connection with light-sources of high brilliancy, the author says:

"In regard to diffusing media, one purely mathematical proposition is to be mentioned —namely, the image of any object seen against the face of a lens, prism or other refracting system, is just as bright as the object from which it is formed. There is, it is true, always a small loss of light in passing through a layer of glass, but this is nearly constant, about 10 per cent. The fact that the image of an incandescent filament seen through a prismatic reflector appears tenths of an inch in width, while the filament itself is actually thousandths of an inch in diameter, does not mean that the apparent candle-power per square inch, as far as the eye is concerned, is reduced a hundredfold. This quantity is reduced in such a case about as much as it would be in viewing the filament through a sheet of clear glass. That is, the eye is looking at a filament a hundred times as large as the actual filament, and (less by an insignificant fraction) exactly as bright in terms of candle-power per apparent square inch."

This is an important point in the subject of glare, and has a wider application than the mere production of images by prismatic or ribbed glass. A mirror reflecting surface of exceedingly small dimensions may likewise produce an image of a light-source that is if anything more annoying to vision than the larger image of the source itself.

The writer takes up somewhat definitely the question upon which much divergence of opinion has existed, as to the relative intensity of the surrounding space as compared with special illumination that is most conducive to ocular comfort, some claiming that practically total darkness is the preferable condition, others that there should be comparatively little contrast. The author cautiously gives his opinion that the surrounding illumination should be somewhere near one-tenth that of the special field of vision.

The question of side illumination, *i. e.*, of illumination received from any point outside the field upon which the eye is focused, is then treated historically, the work of different investigators being briefly stated.

The same general subject is continued under the topic of "Light-Sources in the Field of View," which is devoted to a rather technical examination of the different views held by investigators in this line.

Reflection Coefficients, by Paul F. Bauder.

The object of the paper, according to the author's statement, "is to bring out the necessity for obtaining more definite data upon the absorbing and reflecting values of various surface media when used in conjunction with the many commercial, artificial and natural systems of illumination." A list of the various commercial light-sources is given, upon which the following comment is made:

"When the artificial light-sources are compared with daylight as a source one is at once brought face to face with the fact that none is at present able to approach, except in a very small degree, the effect obtainable from daylight."

As the carbon-dioxide vapor lamp of Moore is given in the list, the author's statements hardly correspond with the facts, as it is now well established that the light from this source is a perfectly satisfactory equivalent for daylight in color value. A table is given comparing the colors and wave lengths of light from a blue sky and carbon and tungsten lamps.

The necessity for considering the psychological effect of the colors of walls and ceilings is brought out, the statement being made that the importance of properly diffusing the light has been given no serious consideration by the manufacturers of interior finishings, such as paint, wall-paper, tapestry, etc., applied to walls, ceilings, floors, furniture, etc. The investigations recently made at the U. S. Naval Academy are referred to, bringing out the fact that a greenish-yellow was preferred for shady rooms, and green for sunny rooms. Tables of colorimeter readings of various luminants and with different colored wall coverings, with the percentage of reflection from different light-sources and of the efficiency of various kinds of glass globes, form a valuable part of the paper.

The Chicago section held its January meeting on the evening of the thirteenth, as guests of the Electrical Show. The evening was given up to the discussion of "Luminous Efficiency," a paper presented before the Philadelphia section last January on this subject by Dr. H. E. Ives forming the basis of the discussion.

The New England section held its January meeting on the evening of the ninth. Dr. Cobb read his paper on "Physical Points Bearing on Glare," which was presented later before the New York section. A paper was also presented on

THE ILLUMINATING ENGINEER AND THE FIXTURE DESIGNER, by Mr. David Crownfield.

The writer frankly stated that the fixture designer leans more toward the esthetic side of the problem than to the purely utilitarian, but readily admits that both elements must be given due consideration, as well as the economical side of the question, in order to produce generally satisfactory results. He then gives an analysis of the problem of lighting, which includes the use of the room, the type and kind of lamp, proper quantity and method of distribution, the location of light-sources, the esthetic requirements and the decorative necessities.

Mr. Crownfield stated in his paper that the lighting should never be the dominant feature of a room, but somewhat reversed this statement in his discussion, in which he stated that "it is perfectly proper to make the fixture the highest decorative note in the room." Perhaps the author meant to distinguish between the fixture and the lighting, in which case he shows a pardonable pride in the work of his handicraft.

The question of indirect lighting came in for a considerable part of the discussion, and received rather severe criticism.

American Physical Society

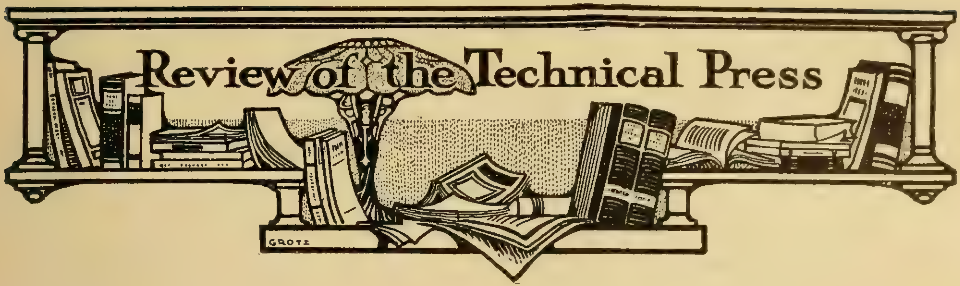
At a joint meeting of this Society with the American Association for the Advancement of Science, held in Minneapolis, December 30, a paper on the "Effect of Wave Form Upon Incandescent Lamps" was read by Mr. Martin G. Lloyd. The paper is strictly technical, and of value only to those who are thoroughly familiar with higher mathematics and the phenomena of the alternating current.

Association of Iron and Steel Electrical Engineers

At a meeting of this association, held in Pittsburg, October 20, a paper was presented on "Illumination of Iron and Steel Mills" by Mr. George H. Stickney. The writer gives a succinct review of the principles of illumination involved, and discusses the various forms of electric lamps and gives directions for their use in different branches of the work.

National Civic Federation

At a meeting of the Welfare Department, held on January 12, a paper was presented on "Light Work Rooms" by Mr. Arthur A. Ernst. The paper was largely devoted to a plea for better lighted work rooms, which was based upon both economic and humanitarian arguments.



American Items

SPECIAL LIGHTING AT GREEN BAY, WIS; *Electrical World,* December 22.

TUNGSTEN CLUSTER LIGHTING OF MICHIGAN BOULEVARD, CHICAGO; *Electrical World,* December 22.

THE ELECTRIC LIGHTING FOR POLICING; *Electrical World,* December 22.

A letter to the editor from James Z. George, Memphis, Tenn.

LIGHTING FIRE ALARM BOXES IN ROCHESTER, N. Y.; *Electrical World,* December 29.

A SUGGESTIVE GAS CAMPAIGN AT CHICAGO; *Electrical World,* December 29.

A short description of the recent campaign by the Peoples' Gas Light & Coke Company of that city for pushing gas lighting.

WAUPACA STREET LIGHTING CONTROVERSY; *Electrical World,* December 29.

ILLUMINATING ENGINEERING ACTIVITY IN GREAT BRITAIN; *Electrical World,* January 12.

A short discussion of the work being covered by the various technical societies throughout Great Britain on this very interesting subject.

TUNGSTEN LIGHTING IN PROSPECT PARK, BROOKLYN, N. Y.; *Electrical Review and Western Electrician,* December 24.

CLUSTER LIGHTING FOR WALLA WALLA, WASH.; *Electrical Review and Western Electrician,* December 24.

A description of a new installation of combined lighting and trolley poles in the above mentioned city.

INDIRECT LIGHTING OF CHURCHES; *Electrical Review and Western Electrician,* December 24.

A description of an installation of indirect lighting in a church at Rome, N. Y.

ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING; *Electrical Review and Western Electrician,* January 7.

The above is a title of a chapter entitled "Review of the Year in the Electrical Industry" in the annual review number.

THE LIGHTING SITUATION, by Dr. Louis Bell; *Electrical Review and Western Electrician,* January 7.

A review of the progress made in the lighting field during the past year.

After treating of the progress made in each division of the general field with his usual manner that it is at once brief and comprehensive, Dr. Bell makes the following exceptionally broad and far-sighted conclusions:

"The improvements in street lighting by gas will undoubtedly help on the cause of more liberal electric lighting. In fact, one is almost tempted to intimate that the invention of greatest benefit to the electrical business since the incandescent lamp is the Welsbach. It was not loved at its first coming, but it is perfectly safe to say that without its competition central station lighting would today be on a smaller and less profitable scale than it is.

"The line of improvement most needed in

street lighting seems to the writer not a matter of material but of its application. A better recognition of the relative importance of streets from the standpoint of illumination is sadly needed. The popular tendency is generally toward an allowance of a certain sum per mile of street, which tendency always leads to mediocrity and results in important streets being too little lighted and unimportant ones altogether too much lighted. There is no more need for lighting all the streets of a city all alike than there is for paving them all alike, and when this fact is recognized the secret of efficient and economical lighting reveals itself."

INCANDESCENT LAMPS IN 1910, by Charles S. Scott; *Electrical Review and Western Electrician*, January 7.

An article on the progress made in the incandescent lamp industry during the past year. The following statement is very significant:

"1.—Rule-of-thumb methods are rapidly giving way to scientific methods. Incandescent lamp manufacturers are depending more upon the scientific expert than the individual experience of older foremen. Scientific research and development work are leading to modifications in old processes, and the establishing of new methods. They are finding a large use for scientifically trained young men, and on the other hand, college graduates are finding an enlarging field of possibility as scientific experts, as manufacturers and as commercial illuminating engineers in connection with the incandescent lamp industry."

THE HISTORY OF GAS LIGHT IN VALLEJO, by E. C. Jones; *Journal of Electricity, Power and Gas*, January 14.

GROWTH OF THE INCANDESCENT LIGHTING INDUSTRY, by G. P. Scholl; *Electric Journal*, January.

A short article descriptive of the progress made in the incandescent lamp industry during the past year.

A NEW ERA IN ELECTRICAL ILLUMINATION, by R. W. Hutchinson, Jr.; the *Engineering Magazine*, January.

This is the second chapter of the above article, which is devoted particularly to flaming, luminous arc and vapor lamps, and accompanied by numerous illustrations.

THE CARE OF TRAIN LIGHTING BATTERIES, by S. W. Everett; *Railway Electrical Engineer*, January.

HISTORY AND DEVELOPMENT OF THE INCANDESCENT LAMP INDUSTRY, by R. E. Campbell; *Electrocraft*, January.

An article tracing the growth of the electric incandescent lamp.

WILMINGTON, DEL., LIGHTED UP; *Selling Electricity*, January.

A short article accompanied by illustrations on the new decorative lighting in that city.

TUNGSTEN STREET LIGHTING IN CHEYENNE; *Selling Electricity*, January.

A short description of their new ornamental lighting installation.

NOTES ON ELECTRIC LIGHTING, by Caryl D. Haskins; *General Electric Review*, January.

This is Chapter IV. of the above article.

MUNICIPAL ILLUMINATION IN TORONTO; *Canadian Electrical News*, January.

An illustrated article on the new lamp-posts now being installed.

LINCOLN AVENUE BRIGHTENED; *Electric City*, January.

A short illustrated article on the new ornamental lighting on Lincoln avenue, Chicago.

OUTDOOR LIGHTING IN ENGLAND, by Norton H. Humphreys; *American Gas Light Journal*, December 26.

This is Chapter VIII. of the above serial.

PROGRESS OF GAS ARC LIGHTING, by John J. Larkins; *Progressive Age*, January 2.

A short article on gas arc lighting in Chicago.

STORE LIGHTING WITH GAS AND ELECTRICITY; *Progressive Age*, January 2.

A short article descriptive of a competitive installation of inverted gas lamps and incandescent electric lamps, Portland, Me.

THE BEST LIGHTED OFFICE BUILDING IN THE WORLD, by Joseph A. McMeel; *Progressive Age*, January 16.

A short illustrated article descriptive of the lighting of the new offices of the Denver Gas & Electric Company.

Apparatus for Flashing Gas Light, by R. T. Hugo; *Progressive Age*, January 16.

A short illustrated article descriptive of an apparatus for automatically flashing a gas light.

Tarnishing of Gas Fixtures, by Norman Macbeth; *Bulletin*, National Commercial Gas Association, January.

A short article detailing the numerous metal finishes of gas fixtures.

How to Light Large Areas Cheaply, by J. R. Cravath; *Factory*, January.

An illustrated article describing some of the various methods for lighting large areas, such as foundries, steel mills, blacksmith shops and bridge works.

Further Studies of the Firefly, by Herbert E. Ives; the *Physical Review*, December.

An article describing the experiments carried out by special photographic method verifying the conclusions reached by Langley that the firefly gives out only visible radiations. The author says: "The results of the present investigation may be said to render still more probable the belief that the firefly produces only visible radiation of high efficiency. There is no evidence that the light is due to anything other than a true production of light by some bio-chemical process, which, as Langley remarks, we know nothing to prevent our successfully imitating."

Volume Ionization Produced by Lighting of Extremely Short Wave Lengths, by Frederick Palmer, Jr.; the *Physical Review*, January.

Studies in Luminescence: Chapter IV. on Fluorescence and Phosphorescence Between + 20° and — 190°, by Edward L. Nichols and Ernest Merritt.

Studies in Thermo-Luminescence: A Description of Light in the Luminescence Spectrum of Sidot Blende, by C. A. Pierce; *Physical Review*, January.

The Evolution of Artificial Illumination, by J. J. Forbrick; *Building Management*, January.

Photometric Units and Nomenclature, by E. B. Rosa; *Bulletin of the Bureau of Standards*, November, 1910.

Street Illumination; *Municipal Journal and Engineer*, January 4.

A general discussion of the problem of public lighting comparing the advantages of the different types of lamps available, with suggestions for selecting the type most suitable for the different classes of illumination.

Street Lighting During 1910, by E. L. Elliott; *Municipal Journal and Engineer*, January 4.

A condensed review of the movement for decorative street lighting, and relative merits and demerits of the various types of lamps and methods of using them which now prevail.

Intense Street Lighting, by Alton D. Adams; *Municipal Journal and Engineer*, January 11.

An illustrated article giving brief descriptions of decorative lighting systems of different types in a considerable number of studies, with much valuable data regarding the cost of installation and operation.

Gas Mantles; *Fibre and Fabric*, December 24.

A short article on the manufacture of incandescent gas mantles.

Seattle's "Great White Way," by Frank Adrian; *Signs of the Times*, January.

A short illustrated article descriptive of the new electric signs on Seattle's "Great White Way."

Some Recent Theories and Researches in Light, by H. D. Minchin; *Optical Journal and Review*, January 12.

A short article reviewing very briefly the history of the laws and theories of light with a popular explanation of the wave theory. The recent theories are simply mentioned.

Optometry and Illumination, by C. E. Folsom; *Optical Journal and Review*, January 12.

A brief but excellent article, the thesis of which is that the optician should both become more familiar with illuminating engineering principles, and should make more definite inquiries concerning the condition of illumination to which his patients are subjected. The following paragraph is especially forceful:

"It is the custom of the writer, when consulted with reference to uncomfortable vision, to inquire into and get definite information as to quantity and character of illumination used by the patient when engaged at the near point. We hear much about having the school room properly lighted, but the almost barbarous illumination under which the larger part of our school population put in their study hours at home receives little public attention. And yet here it is that the most exacting eye work of the day is often performed."

Editorials

Electrical World:

What Is Daylight, December 22.

Tungsten Versus Welsbachs for Street Lighting, January 5.

Electric Lighting, January 5.

Progress in Photometry, January 5.

Illuminating Engineering, January 5.

Some Peculiarities of Diffuse Reflection, January 12.

Coefficient of Reflection, January 19.

The Eye and Artificial Light, January 19.

Electrical Review and Western Electrician:

Street Lighting and Power Rates, December 24.

The Placing of Street Lamps, December 31.

The Effect of Wave Form Upon Incandescent Lamps, January 14.

Engineering Record:

Recent Progress in Street Lighting, January 21.

Central Station:

The Lamp of the Future, January.

Electrocraft:

The Contractor of the Illuminating Engineering Society, January.

Lamp Light as Affected by Wave Form, January.

Foreign Items

Compiled by J. S. Dow

Illumination and Photometry

The Photometrical Laboratory at University College (London), by W. C. Clinton (*Illum. Eng.*, Lond., January, 1911).

Contains a description of the apparatus and methods used at University College for determining polar curves of light distribution, etc.; special reference is also made to the exactitude of modern determinations of the candle-power of incandescent electric standards. Particulars of tests of lamps at University College, the National Physical Laboratory and the Reichsanstalt show very good agreement.

Candle-power Versus Illumination, by K. Edgcumbe (*G. W.*, December 3, 17).

In this correspondence the author points out difficulties connected with street lighting specifications, involving measuring candle-power at arbitrarily selected angles.

Ueber Emission und Absorbtion Leuchtender Gase bei Hohen Stromdichten Unter Verwen-

DUNG VON GLEICHSTROM, by W. Jungjohann (*Zeit. f. wiss Photographie, etc.,* December, 1910).

An account of a series of theoretical researches on the qualities of various luminescent gases.

PHOTOMETER NACH LUMMER UND BRODHUN FUR ZWEILAUFIGE BEOBACHTUNG, by H. Krüss (*Z. f. Inst. Kunde,* November).

The author describes an ingenious device, enabling the Lummer Brodhun photometer to be used for binocular vision.

BRIGHTNESS PHOTOMETERS, by Dr. C. H. Sharp (*Electrician,* December 9).

In this correspondence Dr. C. H. Sharp refers to the previous use of his own instrument for measuring surface brightness. He also advocates the use of an ammeter with portable illumination photometers. In a subsequent letter replying to this J. S. Dow points out the limitation to portability imposed by adding an electrical instrument, although this could, of course, be done.

STREET LIGHTING COSTS, by C. Toone (*Elec. Rev.,* December 2).

PUBLIC LIGHTING IN THE CITY OF LONDON (*Electrician,* December 16).

LIGHTING OF A GEOLOGICAL MUSEUM (*Elec. Field,* December).

EIN CHROMOSKOP (*Z. f. B.,* November 30).

Refers to a new instrument for matching colors and preserving a record of them. The device is based on the fact that with two Nicol prisms and a plate of quartz of specified thickness in between certain definite and reproducible color changes in the field of view can readily be secured.

REVIEW OF PROGRESS DURING 1910 (Editorial, *Illum. Eng.,* Lond., January, 1911).

A succinct account of the chief features of interest in European illuminating engineering progress during the past year. Special reference is made to the work accomplished by the Illuminating Engineering Society in London, which has just complete its first session and held two meetings in the second.

Electric Lighting

THREE-PHASE ARCS, WITH FOUR CARBONS, by L. Crouch (*Elec. Rev.,* December 9).

The writer summarizes some results obtained by Righi in Italy and others on three-phase arc lamps; this matter has been referred to in these columns before. The three carbons are each attached to one phase and a fourth neutral carbon, on which these three converge, is also employed.

ELEKTRISCHE BELEUCHTUNG IN FABRIKEN, by Dr. L. Bloch (*A. E. G. Zeitschr.,* December).

THE BLACKENING OF TUNGSTEN LAMPS, by G. W. O. Howe (Paper read at the meeting of the Illuminating Engineering Society, London, on December 9; *Illum. Eng.,* Lond., January, 1911).

The author describes some experiences with high candle-power tungsten lamps. Several of these blackened in a rather singular manner, images of the filament and its support being cast in silhouette on the bulb. This effect is traced to the projection of particles from the point where the leading in wire enters the bulb, and is found to consist mainly of copper.

RECENT PROGRESS IN ELECTRIC LIGHTING, by W. E. Marchant (Paper read at a meeting of the Illuminating Engineering Society, London, December 9; *Illum. Eng.,* Lond., January, 1911).

This is a general paper summarizing progress in incandescent, arc and mercury vapor lamps; an account is also given of tests of the mercury quartz tube lamp. One interesting point examined by the author was the question how far switching on and off of glow lamps had a prejudicial influence on their life and efficiency. A device was arranged to extinguish and light up lamps at frequent intervals, but so far as the tests have gone, this does not seem to have prejudicially affected the life. At the conclusion of the paper there is an account of the construction of a

globe-photometer, and details are given of tests carried out with the apparatus.

DIE KUNST IN DER BOGENLAMPE, by H. Pudor (*Z. f. B.*, December 10).

The author lays stress on the need for further study of esthetic principles in connection with arc lamps, for example in the design of their cases, etc.

NOTES ON FILAMENT MANUFACTURE (*Illum. Eng.*, Lond., January, 1911).

An article summarizing some patent processes for making metallic filaments. "Cored," "mixed metal" and "alloy" filaments are considered; the methods based on drawing out wire tungsten wire very fine seem to be now yielding good results.

THE ELECTRIC LIGHTING INSTALLATION AT THE INSTITUTION OF ELECTRICAL ENGINEERS (*Illum. Eng.*, Lond., December, 1910).

A description, with illustrations of this new installation, followed by a critical examination in the form of a conversation. The installation was briefly described in the last review.

NEUERE BOGENLAMPEN (*Z. f. B.*, November 30; December 16).

Gas, Oil, Acetylene, Lighting, etc.

RECENT PROGRESS IN GAS LIGHTING, by F. W. Goodenough (Paper read before the Illuminating Engineering Society November 8; *Illum. Eng.*, Lond., December, 1910).

Some particulars of this paper, and of the discussion which followed, were given in a previous review shortly after the paper was read. The paper and discussion, and also summaries of other contributions from foreign correspondents, are published *in extenso* in the December number of the official organ. Additional communications from C. O. Bond and C. R. Bohm are published in the January number of the journal.

REQUIREMENTS OF ILLUMINATION AND THE STATUS OF GAS LIGHTING, by J. C. Briggs (*J. G. L.*, December 13).

This is a general paper. It is chiefly interesting for the considerable attention called to illuminating engineering matters, such as qualities of globes, color of illuminants, etc., in connection with gas lighting.

STADTISCHE MUSTERLAGER VON GASAPPARAT, by W. Zachert (*J. f. G.*, December 3).

Refers to an innovation of municipalities in certain German towns. The municipality provides premises devoted to the display of gas appliances, and contractors are invited to exhibit. A small commission on all sales is charged to cover rental, etc.

L'ACETYLENE DANS LES EGLISES (*Rev. des Eclairages*, November 30).

LIGHTING IN THE STREETS OF LONDON (*G. W.*, December 3).

DAS GEGENSTROMPRINZIP (*Z. f. B.*, November 30).

THE CALCUTTA PUBLIC LIGHTING CONTRACT (*J. G. L.*, November 29).

LA LUMIÈRE GRAETZINE (*Le Moniteur de l'Industrie du Gaz et de l'Electricitè*, December 15).

Contractions used:
Elec. Rev. Electrical Review (London).
G. W. Gas World.
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
J. G. L. Journal of Gaslighting.
Illum. Eng. Lond. Illuminating Engineer (London).
Z. f. B. Zeitschrift für Beleuchtungswesen.